OCTOBER 1985 • Volume 8 • Issue 10

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SPECIAL: MASS STORAGE FROM FLOPPIES TO VIDEO DISCS

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PLUS Cheap satellite receiver for the BBC Micro

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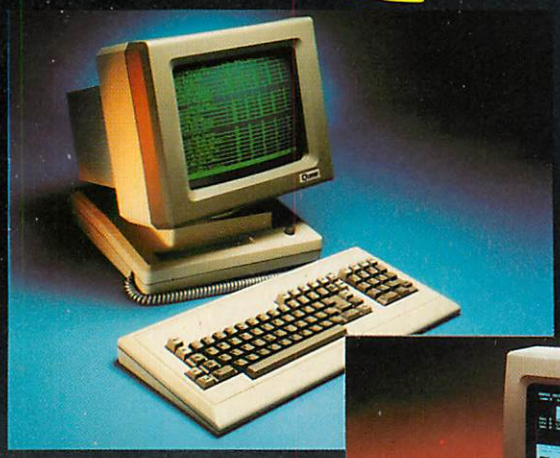

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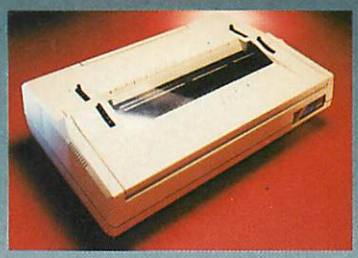

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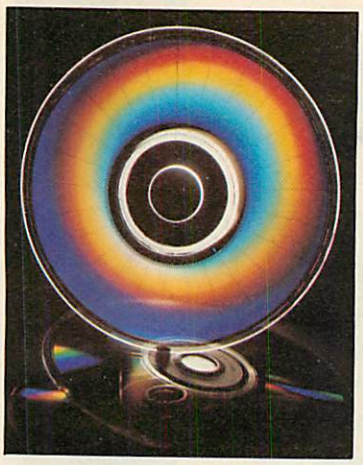
COVER FEATURE



MASS STORAGE

Everything from RAM chips to video discs is covered in this month's special feature on mass storage. We offer an overview of the market, and clearly explain the advantages and disadvantages of each medium, covering not only the more exotic offerings, like Bernouilli drives, but all the varieties of floppy and hard discs too. Then on page 111, *Mike Lewis* provides a practical guide to using the most popular form of storage, the 5.25in floppy disc **100**

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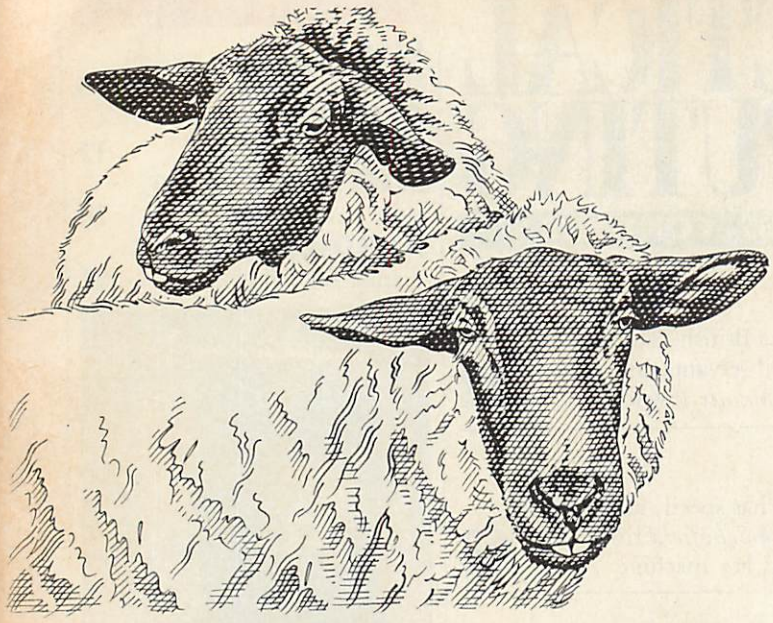

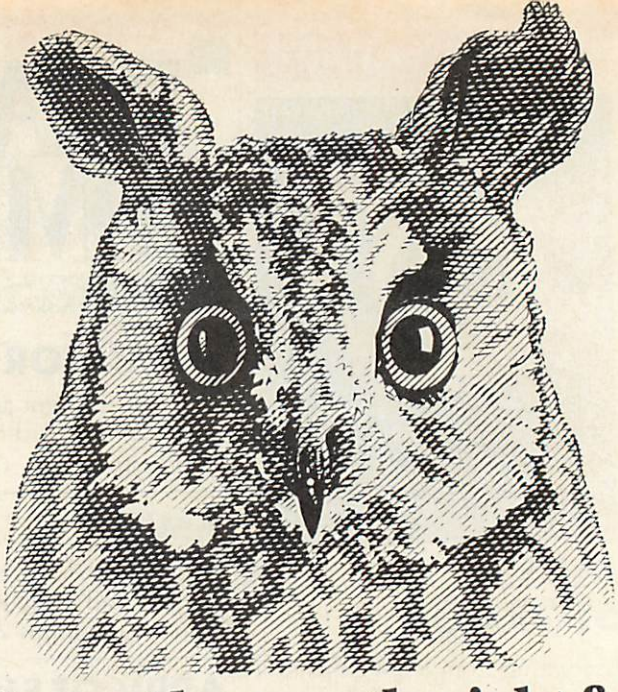

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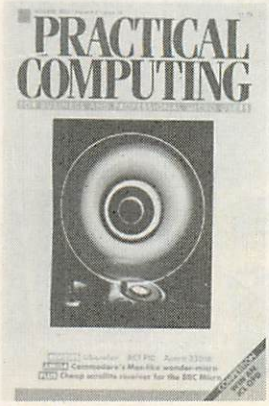

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THE END OF THE IBM PC?

Like it or not, the IBM PC represents the current standard in the serious microcomputer business. It is the machine for which most software is written, and against which most others are judged. The question people are now starting to ask is, how much longer can it last?

The IBM PC is not the first standard. Previously other companies have dominated the micro market. First it was Mits with the Altair, then Apple with the II, and after that we had a large number of 64K CP/M machines ruling the roost. Each was in turn "the only thing to buy". Each was, in a few years, relegated to second-best, if not dumped altogether.

Today the IBM PC is nearing the end of its life. The design which was so stunning in August 1981 is now creaking with age. The video display arrangements are a mess, and the enhanced graphics adaptor launched recently does not look like a good solution. Too many things — like ports and floppy-disc controllers — are still on expansion cards. The Intel 8088 CPU, with its eight-bit data bus and snail-like 4.77MHz clock speed, is ancient history in chip technology. The main board design has too many chips, making it too expensive to be viable in today's marketplace. And so on. For now, what keeps it afloat is the mass of software available, and those corporate buyers who are, for safety's sake, always at least two years behind technology's cutting edge.

IBM knows all this as well as anyone, and a year ago launched the PC/AT to establish its dynasty. For various reasons it has not happened. IBM has had problems delivering working ATs in large volume. There is little or no software which actually requires people to buy an AT rather than a PC. And the AT's performance has already been matched by a far cheaper Olivetti clone, the 8086-based M-24, and surpassed by Compaq, with the 286.

We have waited for IBM to fight back by launching its 80186 or 80286-based PC II. Now the U.S. arm of IBM has stated that no PC II will be launched this year. We can only speculate on the reasons. Presumably IBM has been hit, like everyone else, by the slump in the sales of micros. Perhaps a few hundred thousand are sitting in warehouses. And perhaps the cost of manufacture is so high that IBM can no longer stimulate demand in its usual fashion by cutting the price. If so, IBM is in a tough spot.

IBM has also released documents which show it is working on a new micro based on the yet-to-be-announced Intel 80386 chip, probably for launch in late 1986. The full 32-bit architecture might be exploited by a new operating environment which combines DOS, Unix and IBM's own VM mainframe operating system. This Topview-like linker appears in an IBM diagram identified only by a question mark.

This fits in with the way IBM has attempted to drag the PC back into its main systems area by launching desk-top minicomputers in PC boxes. It also fits with IBM effectively killing off the wildcat Boca Raton division that actually produced the PC — flying in the face of most IBM traditions to do it — and throwing the remains in with the corporate wolves.

All this suggests the end of an era. The next one starts next year with contenders that should include Apple with the Macintosh, Atari with the 520ST, Commodore with the Amiga, and perhaps ACT and Amstrad representing the U.K. The common theme could be summed up as more than twice the power of an IBM PC for less than half the price, or something similar.

No doubt IBM PC-type products will, like Apple IIs, carry on selling for many years: the Olivetti, Compaq and other enhanced versions should ensure that. But it remains to be seen whether IBM can continue to compete in, let alone dominate, a market that is still changing fast.

5 YEARS AGO...

Two new add-ons designed to expand the capabilities of the Sinclair ZX-80 have just been announced by Science of Cambridge. At their launch, inventor Clive Sinclair claimed that the ZX-80 is now out-selling all the other personal computers combined in the U.K. market.

To date, 17,000 ZX-80s have been sold and units are manufactured at a rate of 300 a day, increasing to 500 at the end of the year and 40 percent are exported; particularly to the U.S. via the Sinclair office in Boston. Exports are expected to reach 70 percent over the next six months, as new overseas markets, such as Sweden and Australia, are tackled.

In answer to complaints from users, Clive Sinclair tells *Practical Computing* that the delivery problem — a constant source of complaints for some weeks — has now been solved. He says: "When we first advertised the product, we had no idea of what the response would be and, in fact, it was miles ahead of expectations. We had planned delivery time for four weeks. At one point, it rose to nine weeks but we have re-phased our production and it is now back to four weeks or less for assembled models."

PC Volume 3 Issue 10

RAMROM 15

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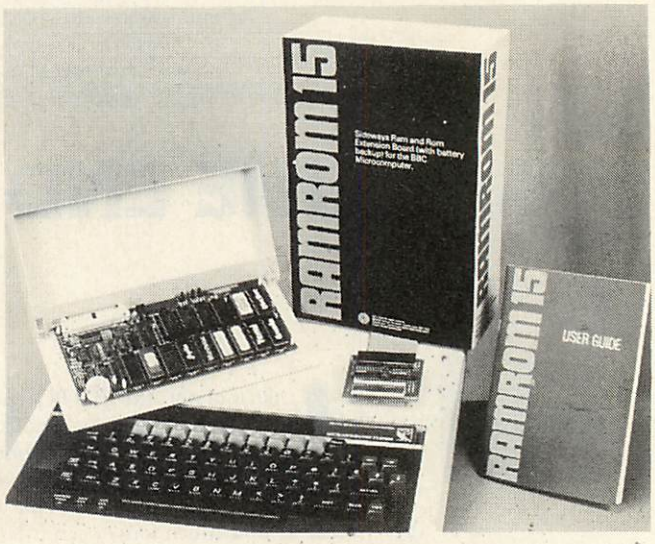

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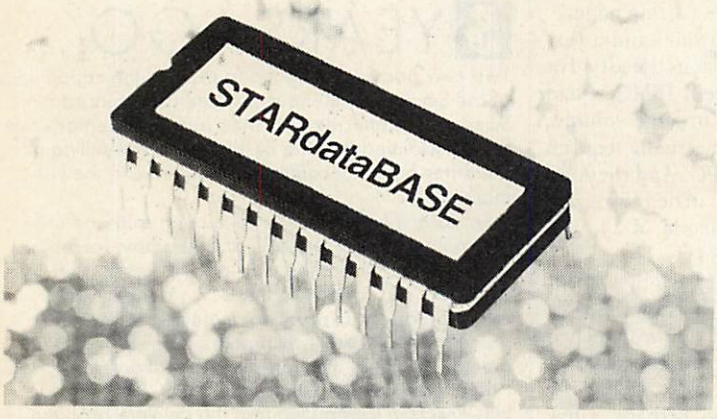
The database



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FEEDBACK

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback — it is your chance to keep in touch.

Write to

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Sutton, Surrey SM2 5AS

Data transfer by cellular radio

I AM DELIGHTED to be able to tell you that Transam have developed a modem suitable for use with cellular radio which overcomes the four separate phenomena that Ben Knox describes in his August column. Known as the Transam M1, it employs error-correction techniques based on a positively acknowledged data block with CRC checking.

When data is being transmitted, the Transam M1 automatically selects a speed of 300 or 1,200 baud to make the most efficient use of the line. When the vehicle is moving, the Transam M1 is used in Intelligent mode and it is necessary to use this modem at both ends. A unique algorithm codes the transmitted data which is then checked at the receiving end by a similar algorithm.

Although I do not wish to initiate a controversy on standards for data transmission I would like to make the following points.

- CDLC is expensive; I understand the Racal modem will be around £600. The Transam M1 is £350.
- Research shows that most users will want to access database/electronic-mail services. This does not require the high speed, full duplex operation of CDLC.
- The Transam M1 is fully compatible with existing V-21 and V-23 services.

So there are alternatives to CDLC and this one exists right now.

I forgot to mention it has a battery option which makes it truly portable, and also makes it the fastest battery-operated modem currently marketed.

GRAHAM CLIFTON,
Transam Microsystems Ltd,
London WC1.

ELECTROSTATIC DISCHARGE

IN *Tomorrow's World* on 25 April there was a three-minute feature on the damaging effects of ESD on microchips. The programme highlighted the problem but presented no solutions.

We know that manufacturers of electronic equipment take very elaborate precautions to avoid ESD damage to components during assembly. In the U.S. there is a general level of awareness that failure in use is often related to static discharge from the users/operators of equipment, and there are solutions to the problem available.

The *Tomorrow's World* feature was, to our knowledge, the first time the problems relating to ESD had been made public in the U.K., and general awareness appears to be negligible. Static build-up being humidity-related, it is not inconceivable that in the U.K. the problems are minor compared with the U.S., and this could explain the absence of discussion on ESD in such magazines as yours.

We have a wealth of information on the subject culled from American sources and nothing of British origin. Our interest in the matter is that our U.S. associate company has a solution to the problem for PC users, which we can make available in the U.K. but the marketing of such a product is rather pointless if no real problem exists in this country.

My purpose in writing to you is to seek advice in the matter. Quite, simply: is ESD a matter of concern to PC users, or not?

BRIAN HAMER,
Formica Limited,
Coast Road,
Tyne & Wear NE29 8RE.

THE EDITOR ADDS: What do readers think?

Proportional spacing from Word Perfect

THE ULTIMATE TEST of any word-processing package is the quality of the printed output that results from it, and the ease with which this can be brought up to the highest standard of which the printing hardware is capable.

From this point of view, you did well to reproduce some samples of printed ouput in your review of Word Perfect in the August issue. Although I have not used this package, I did spend some time investigating it after reading some other reviews that were as enthusiastic as yours, though they did not reproduce samples of its output. The conclusion that I reached was that, although it has many attractive features, it is not at present capable of producing professional-looking proportionally spaced text — a conclusion that I felt was reinforced by the samples in your article, with their rather randomly spaced line feeds and ragged left margins.

Personally, I consider that non-proportionally spaced printing represents a period of history that is now past: a time when people were clever enough to make cheap printing devices but not yet clever enough to get them to cope with the fact that some letters are wider than others.

A good word processor, when using a proportional fount, should make use of the spacing information in the fount to force a Linefeed in an appropriate place, and show it on the screen. Thus, with a typical proportional fount and a 74-character-width line, a Linefeed should occur after about 110 lower-case i characters and about 50 capital Ms.

I could not get Word Perfect to break the line in any place other than after 74 characters, regardless of the size of the character. This also negates the other advantage of proprotional spacing, apart from its greater legibility, which is that you normally get more words per line.

Having become familiar with a good sample of word-processing programs, I have concluded that for ease and transparency of use combined with an adequate range of sophisticated features, Palantir is the best known to me. I wish it had column orientation, macros and other bells and whistles that come with Word Perfect, but I shall not be tempted to switch to any program that threatens to produce a lower quality of printed output.

CHARLES YOUNG
London W1

THE EDITOR ADDS: Although Susan Curran did have this problem with Word Perfect 4.0, others have not — for example on the Apricot version. However, it is correct that the program will not put more characters on a line than the nominal line width.

Computer Consoles Inc.

I READ with interest the interview by Glyn Moody of Mr Fred Lamond in the July 1985 issue of *Practical Computing*. With respect to the question concerning problems IBM has had with the AT, Mr Lamond is quoted as saying that "IBM ordered the hard discs for the AT from an independent computer manufacturer, Computer Consoles." Computer Consoles, Inc. (CCI) a Rochester, New York based supplier of minicomputer systems, has never manufactured hard discs. Additionally, CCI is not and has never been, a supplier to IBM.

We believe there is a significant amount of confusion resulting from the Fred Lamond interview. We would appreciate your correcting this fact for your readership.

HERMAN A AFFEL Jr,
Computer Consoles Inc.,
Rochester,
NY.

Disc benchmarks

AS SUGGESTED in your July issue I downloaded the Bagshaw Disc Benchmarks and timed them on an Olivetti M-24 360K floppy disc, an M-24 integral 10Mbyte hard disc, an M-24 with external 10Mbyte hard disc, an M-21 with integral 10Mbyte hard disc, and an M-24 with 10Mbyte hard disc accessed through the Olivetti 10-net local area network.

One comment is that Disc Benchmarks should be regarded as approximate, as the files location on the disc and the

(continued on next page)

(continued from previous page)
amount of segmentation that occurs — which is dependant on how the disc is organised — can change the results. For these tests I did not use new discs but averagely disorganised ones.

The network one is especially interesting as it backs up the view that the network data speed is not that important. If one considers that the IBM PC cannot load data on to a network at a speed greater than about 30K/second and the M-24 about 50K/second, then of greater importance is the disc you are using.

BOB GARRETT,
British Olivetti,
London SW15.

HERE ARE the results I achieved running the Bagshaw Benchmarks on our Comart CP-2542 under CCP/M-86 in the office. I tried them using first Locomotive's Mallard interpreter, which we use for our accounting system, and then using Microsoft's Basic-86, CP/M-86 version 5.22. Neither test employs the RAM disc in the Comart, but uses the 40Mbyte hard disc, which is partitioned into eight 5Mbyte virtual drives.

I found it curious that the Basic times for MBasic were significantly faster than those returned by Mallard, as Mallard is so much faster in the operation of our Compact accounts system. This I attribute to Compact's implementation of Locomotive's Jetsam file handler; if I get time I'll adapt the Benchmarks to run with Jetsam.

NOEL MAWER,
81: DGS1351.

THE EDITOR ADDS: The Bagshaw Benchmarks can be downloaded from TBBS on 01-348 9400. Parameters are: 300 baud; eight data bits, no parity; one stop bit; and Modem 7 protocols for file transfer.

Basic Benchmarks

THE LETTER from H J Gawlik in your July issue has somewhat reassured me. Only 198 seconds for the bubble sort for a Commodore 3032? My old steam Vic-20 does it in just over 168 seconds!

A HARRIS,
Bootle.

VIC BUBBLE SORT

```
1 M=100:F=0:N=0:X=0:DIM
U(M):TIME$="00:00:00"
2 FOR N=1 TO M
3 U(N)=M-N:PRINT N,U(N):
NEXT
4 F=0:FOR N=1 TO M-1
5 IF U(N+1)<U(N) THEN X=
U(N):U(N)=U(N+1):U(N+1)=
X:F=1
6 NEXT: IF F>0 THEN 4
7 FOR N=1 TO M:PRINT N,U
(N):NEXT
8 PRINT "TIME = ";TIME$
```

THE EDITOR ADDS: Our IBM PC/XT runs the routine in 161 seconds and thus trounces your Vic-20, though admittedly at 50 times the price. Any other offers?

CP/M programs

I AM INTERESTED in the letters in your July column about the CP/M programs you have published written by John and Tim Lee. First, please do not stop publishing such programs. I find them very useful, and I do not have a C compiler.

I have made use of SList on an Amstrad for my father and on my own Atari/ATR-8000 system. The earlier Como with its adaption of the operating system vectors taught me a lot about what is possible, with no more than ASM which comes free with CP/M. I now have Typewriter and Wordcount in my armoury as well.

Some of the programs do require adaption. The ATR-8000 requires a three-character string for HI and UNI. These are:

HI: 27,41,0
UNHI: 27,40,0

all in decimal. The final zero is not in the manual, but is necessary, presumably to allow time for something to happen. If it is left out then the next character is skipped.

There does seem to be a bug in the code for Wordcounter as printed on page 116 in July, in that surely the two lines at 01C6 and 01C9 should follow all the conditional tests, which as written will only be tested when the character is a Carriage Return.

One suggestion. The different programs often implement the same function — output of a text message, for example — in a way which is in detail different. How about using a set of standard subroutines for these things, with common names?

But these are really small points. The main thing is, please don't stop.

JOHN FLETCHER,
Birmingham.

Why use assembler?

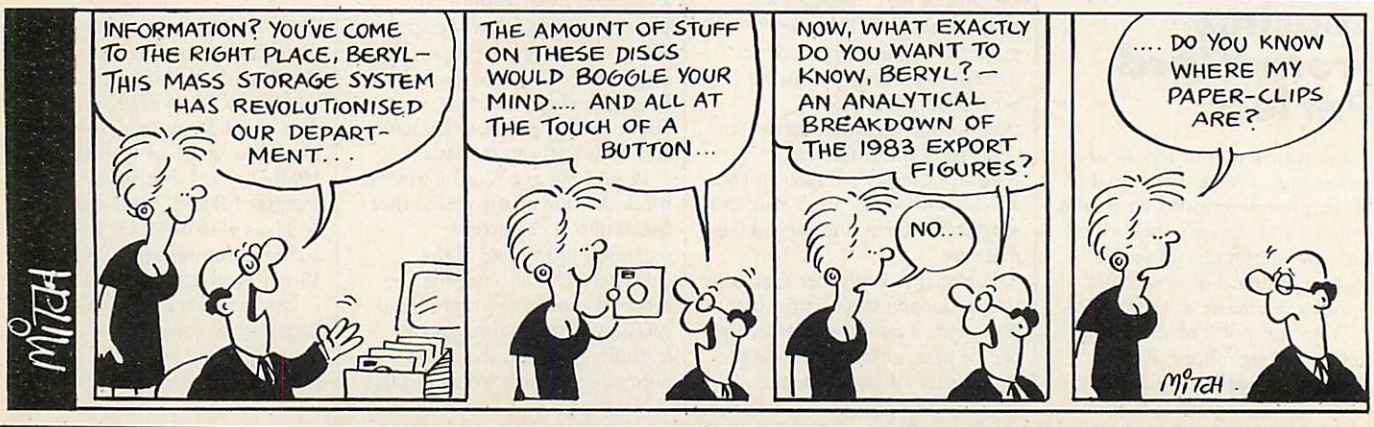
I AGREE with P J Onion — Feedback, July — that there is no need to write utility programs such as the File Lister in assembler. The normal reasons for using assembler are running speed, size of code and the need to carry out operations not available in a high-level language. None of these are a requirement of this particular program, which is therefore better written in a high-level language.

The disadvantages of assembler are that the code is difficult to

(continued on page 13)

BAGSHAW BENCHMARKS

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total
Olivetti M-24 — 360K floppy	14.2	17.2	10.6	27.8	23.3	16.6	5.1	18.8	5.2	7.8	14.5	99.2	58.7	10.8	330
Olivetti M-24 — 10Mbyte hard	9.8	3.9	4.0	5.0	3.1	18.3	1.6	19.0	2.0	1.9	3.0	19.5	15.4	13.0	120
Olivetti M-24 — 10Mbyte ext	10.4	3.8	4.0	5.1	4.3	15.0	2.0	15.9	2.1	2.2	3.2	25.7	16.3	11.6	122
Olivetti M-21 — 10Mbyte hard	10.0	3.8	4.1	5.0	2.7	13.3	1.5	11.6	2.1	2.0	3.2	19.0	14.9	10.0	103
Olivetti M-24 — 10Mbyte 10-net	12.1	5.0	5.2	13.6	11.1	23.1	4.3	27.7	4.6	2.9	4.3	52.0	30.6	14.8	211
Comart CP-2452 — Mallard	5.8	2.1	1.9	4.1	3.7	4.3	0.7	3.7	0.8	1.3	2.4	18.2	7.0	2.1	58
Comart CP-2452 — MBasic-86	7.9	1.9	2.9	5.2	5.0	3.4	0.4	3.8	0.8	1.3	2.3	22.8	10.2	2.1	70



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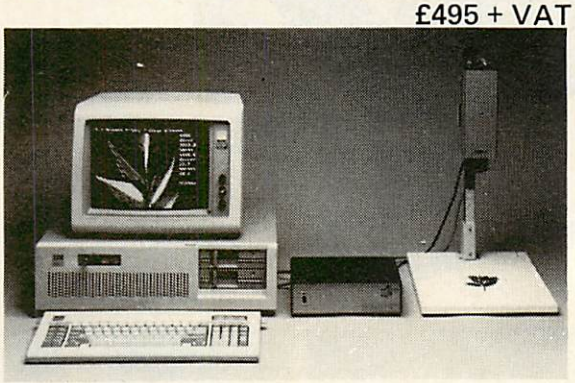

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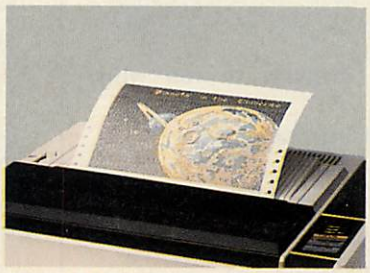

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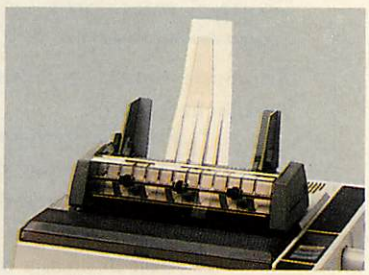

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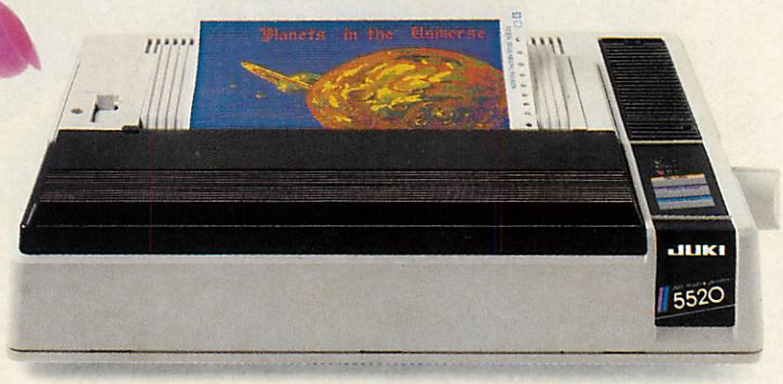

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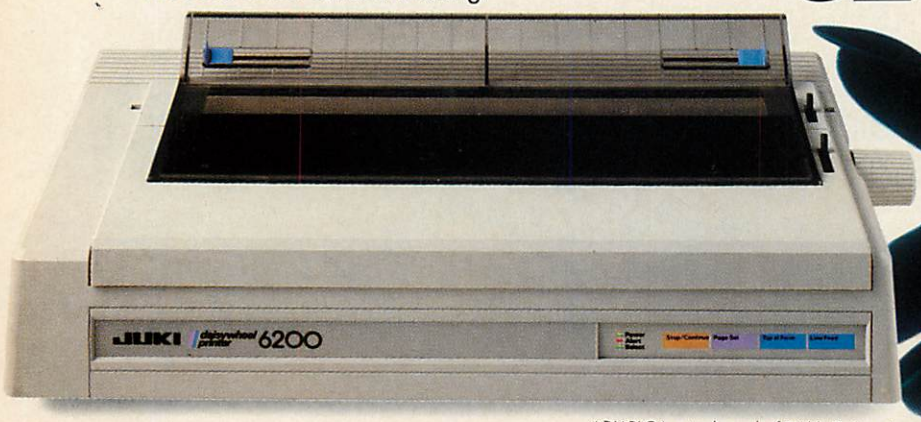

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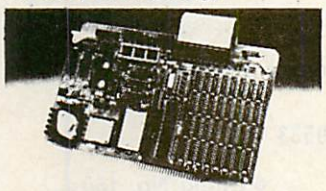

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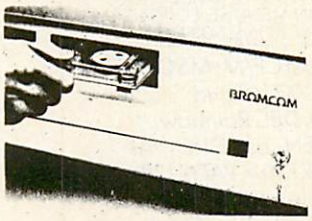

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(continued from page 8)

read and debug. Like you, I find C difficult to read. I prefer to use Pascal and I enclose a version of the File Lister program written using the Turbo Pascal compiler, which is an excellent product selling at a reasonable price.

D HART,
Nottingham.

THE EDITOR ADDS: We don't have room here for the Pascal listing, But we can forward requests to Mr Hart.

Instrument interfacing

I WAS INTERESTED in the problems found by Dr Barry Clark — Feedback, August 1985 — in interfacing the IBM PC with instruments; in particular the relative slowness of Basic and its lack of global variables, etc.

I think the problem lies with the IBM PC as most office micros do not readily lend themselves to real-time instrument interfacing. I worked with a Sirius for a while and had very similar problems to those he relates.

I now work with HP Series 200 computers, which are designed with real-time programming in mind. HP Basic offers interrupts, IEEE-488 bus control and global variables. Sub-programs can be loaded or deleted under program control, and data transfers between instruments and peripherals can take place concurrently. The Basic is very fast, but where extra speed is required one can program sub-programs in assembler or Pascal, which may then be called from the Basic program.

The drawback? The cost of an HP 200 computer will be more than double that of an IBM PC. However, if Dr Clark is writing programs of over 48K in length, then he may find the saving in programming time outweighs the extra cost involved.

I also agree that *Practical Computing* and other publications could do more for the professional scientific micro user by publishing articles on real-time applications and interfacing.

ROY O'CONNOR,
Dietzenbach,
West Germany.

Lonely hearts

I AM in the process of preparing a book entitled *Interactive Learning on the IBM PC.* The plan is to invite suppliers of computer-assisted learning or training packages, authoring languages, interactive video devices and the like to submit moderately unbiased descriptions of their products in a form suitable for publication

If necessary, I can prepare the descriptions for suppliers from outline details. The various descriptions will be grouped according to type and application, and linking narrative will be added as background material for non-expert users.

Although I am aware of some of the available products, many others may have escaped my notice. Therefore, I would like to invite intending contributors to this book to contact me. At this stage I only need to know the outline details of the product, its availability in the U.K. and tentative plans by its supplier either for enhancements or additional products. Also, an indication of the willingness to write a few pages is important too.

GRAHAM BEECH,
Sigma Press,
5 Alton Road,
Wilmslow,
Cheshire SK9 5DY.

I AM interested in contacting users of ACT computers, particularly the Apricot/F1/Portable range, with a view to starting a national user group. The idea would be to cover the full range of computing with things of interest to business, home and educational users. If anyone would like further details please write to me, enclosing an sae.

F S CARTWRIGHT,
Rockside,
13 Worley Ridge,
Nailsworth,
Gloucestershire GL6 0PD.

I WRITE to enquire if any Lisp-speaking readers would be interested in forming a corresponding circle devoted to that most interesting of all computer languages. I am sure that devotees of all levels of expertise would benefit from an interchange of ideas. I envisage the production of a newsletter two or three times a year.

JOHN WELLSMAN,
294A Caledonian Road,
London N1 1BA.

ONE OF the main paradoxes of information technology is the lack of co-ordinated information on the subject. I am particularly interested in the advisory area of IT: for example local collaborative projects, Department of Trade office-automation projects, and other local and national initiatives. I would be grateful if any individual or organisation concerned with such projects would contact me so that their details can be included in a directory of sources for information technology.

GRAHAM SMITH,
28 Denewulf Close,
Bishops Waltham,
Southampton SO3 1GZ.

MBasic machine-code subroutines

THANK YOU for publishing my article on "Machine-code subroutines" in the August edition. I have noticed two errors which might lead to confusion if not corrected.

In table 1 on page 103, the first two columns should read:

Intel	Zilog
MOV A, M	LD A, (HL)
ADD A	ADD A, A
MOV M, A	LD (HL), A
RET	RET

Readers who are aware of the intricacies of the MBasic compiler will know that the Demo.Com file referred to in the last paragraph on page 106 will require run-time support from BRun.Com unless the alternative compile and link procedure that involves Obslib is used.

DAVID DAWE,
Redruth,
Cornwall.

Laser printers

YOUR FEATURE on printers in the August issue raised a question in my mind. Why don't laser printers simply burn the image on to the paper? This would probably be a lot faster. It would require very little memory, no light-sensitive drum, no messy toner and very few moving parts. Has anyone tried it?

DAVID N WOMERSLEY,
London E3.

THE EDITOR REPLIES: Our consultant John Hooper has found a British patent from July 1984, Specification 2,133,352, where Laser Applications suggests using a laser beam in this way. But doesn't it make every original a carbon?

Wordcount

THERE WAS an error in Mike Lewis's Wordcount program in Software Workshop, August issue, page 31. The code in line 2030 should read

```
WORDS% = WORDS%+1
```

and not as printed.

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3 Lotus 123
4 Disk formatting menu
5 Exit to operating system

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MENUGEN is available for most CP/M, MS DOS or PC DOS micros including IBM PC/XT/AT and compatibles, Sirius, Apricot, HP150, DEC Rainbow, and many Z80 machines. MENUGEN costs £48 + VAT (£55.20) for a single user licence, or £120 + VAT (£138) for a network licence, and is available from Microft Technology Limited, The Old Powerhouse, Kew Gardens Station, Kew, Surrey TW9 3PS. To order, or for further information, telephone 01-948 8255.

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10Mbyte hard card

IT IS POSSIBLE to fit a hard disc to a PC if you have the money and the room, and can stand the hassle. However, Plus Development plans to make life easier by supplying a 10Mbyte hard disc fitted on to a standard-sized expansion card. You just plug it into an empty slot, run a batch file to install it, and away you go.

The Hardcard has been made possible by using a 3.5in. hard disc to fit the expansion card's 4in. width, and by using custom CMOS chips to reduce the size and power demands of the control circuitry.

The Hardcard is manufactured by Matsushita Kotobuki in Japan, and should be on sale in the U.S. in October at a projected price of $1,095.

Useful books

FOR IBM USERS, *IBM Personal Computer Complementary Products* is an invaluable 114-page catalogue of the hardware and software that works with the IBM PC, XT, PPC and AT computers. Entries range from Alias Accounts to Wordmarc; the only weak section is the one page of games. The IBM Part number is 8132689-1. It is obtainable only via IBM dealers, who can charge what they like for it.

Another book to get is *The Peter Norton Programmer's Guide to the IBM PC,* published in U.S. by Microsoft Press. It's the best reference guide yet to the PC line-up — except, of course, for IBM's technical manuals. It provides full details of the various disc operations and ROM BIOS routines. The price, £16.95, is very low for around 440 fact-packed pages. The U.K. publisher is Penguin Books and the ISBN is 0 14 087144 6.

Dash 2

THE DASH 2 versions of the Sanyo MBC-550 and MBC-555 can be upgraded by adding a £145 video board. This allows most IBM PC software to be run, including Lotus 1-2-3, Flight Simulator and Supercalc 3.

Contact Sanyo Marubeni, Sanyo House, Otterspool Way, Watford, Hertfordshire WD2 8JX. Telephone: (0923) 46363.

DASHER/ONE

DATA GENERAL'S Dasher One is a desk-top work station version of the One lap-top computer. It is designed to be IBM PC compatible and to link into DG's Comprehensive Electronic Office system (CEO). There are two models; one has an ordinary, slow 8088 chip, and the other a dual-speed 8088-2. There is a choice of keyboards, one is a PC-alike and the other follows the CEO design.

In other respects, Dasher is like the DG One — it uses 720K 3.5in. microfloppy drives and has no PC-compatible expansion slots. DG will be producing its own cards.

Like Wang, DG has produced a word processor, Ceowrite, which will run on IBM PCs and Dashers. CEO Connection software allows either machine to be linked to MV/4000 minicomputer-based office systems.

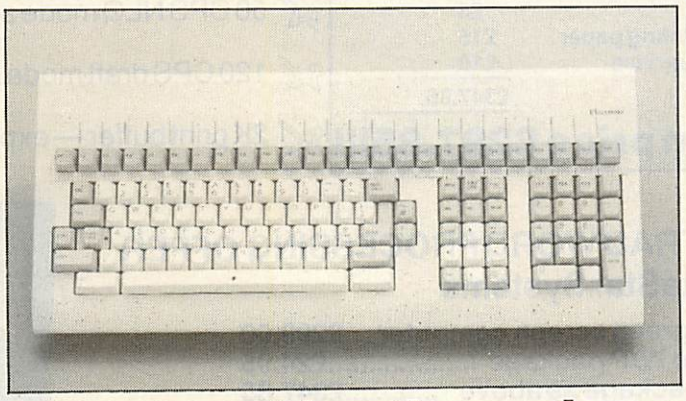
Contact Data General, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD. Telephone: 01-572 7455.

Multi-user PC system

IF YOU absolutely have to turn an IBM PC into a multi-user system, Anex Technology's Multi-PC is one way to do it. The system looks like an IBM PC system box. It provides for four independent terminals, so you can add three work stations. There is room for RAM expansion up to 2Mbyte.

The multi-Lock software provides for log-on and password security and file locking. A multi-spool board handles printing for four users simultaneously. The cost of a four-user Multi-PC system is £8,031.

The Multi-PC is imported by United Business Systems, 263-9 City Road, London EC1V 1JX. Telephone: 01-250 0505.



Improved keyboard

ELECTRONE has produced a new version of its enhanced PC keyboard. It offers an extra 20 user-programmable function keys over the IBM, plus separate cursor and numeric pads which are active in all modes. No more Num Lock!

The keyboard costs £265 plus VAT from Electrone Ltd, Haywood House, High Street, Pinner, Middlesex HA5 5QA. Telephone: 01-429 2433.

Keyworks is a keyboard enhancer to compete with Prokey, Superkey and Smartkey. The distributor is First Software. Tel: (0256) 463344.

E-Z-DOS-It

TRUE MULTI-TASKING is promised by E-Z-DOS-It, a RAM-resident DOS 2 enhancer from Hammer in California. It enables up to eight applications to be run concurrently, assuming you have enough memory. E-Z itself requires a minimum 256K system, though it occupies only 8K during program execution.

E-Z costs £195 from Hal Communications, Invincible Road, Farnborough, Hampshire GU14 7QU. Telephone: (0252) 517175.

IBM SHORTS

- Kode is now distributing the Wyse PC, and has slashed prices. Twin-floppy systems start at £1,400 and the 10Mbyte version reviewed in our April 1984 issue now starts at £2,300. Telephone: (0249) 813771. Logitek has also cut its prices on the same machines. Telephone: (0257) 426644.
- Turbonet PC is a networking system for IBM PCs and compatibles from Equinox, a leading Turbodos systems house. Fileservers can handle eight PCs and can be from 20Mbyte to 330Mbyte. Telephone: 01-739 3450.
- Jeeves is yet more butlerware — but this time it's British. In 16K it provides a calculator, clock/calendar and alarm system, and a 60-line notepad. It links to a world clock database, an address book and a dictionary, which are also supplied for the princely sum of £24. Telephone: (0734) 691349.
- Type Righter is a £19.95 touch-typing program from Hampton Associates for the IBM PC. Telephone: (0285 85) 559.
- Overhead Express is a presentation package that provides 12 templates to make it easy to use. The results can be printed out or presented as a timed screen show. It costs £195. Telephone: 01-729 1411/2.
- Micropro has launched a new low-cost version of WordStar in the U.S. It's called Easy WordStar and is aimed at novices. Telephone: 01-879 1122.
- Ariolasoft is releasing top American programs from Electronic Arts for the IBM PC for £19.95 including VAT. Titles include Seven Cities of Gold and the Music, Pinball and Adventure construction sets. Telephone: 01-222 0833.
- PC Test is claimed to provide a complete test of IBM PC compatibility. It comprises a suite of 120 modules, priced from £29 each or £3,500 for the lot. Telephone: (0202) 297315.
- Anagram Systems has launched multi-user versions of its Integrated Accounting System and Stockmaster packages. Telephone: (0403) 59551.

OPEN SUNDAYS 10 - 1

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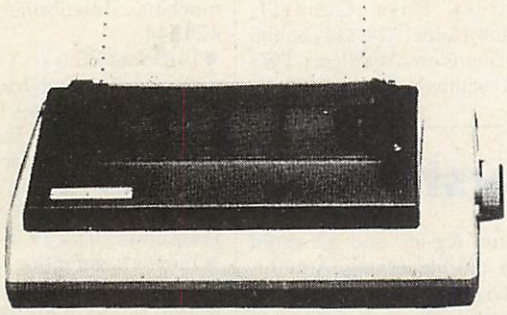

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BT STRIKES MUD

THE MIDNIGHT computer cult surrounding Mud, the Multi-user dungeon, is being offered refuge by British Telecom's New Information Services division.

Mud is a multi-user adventure played by people all over the world, using modems to dial into one of the mainframes on which it runs. It was first implemented in BCPL on a DEC System 10 at Essex University by Roy Trubshaw and Richard Bartle — see *Practical Computing*, December 1983, pages 126 to 130 and January 1985, pages 92 to 93 for Bartle's own account of its development. The original authors are now converting it to run on a DEC Vax 750, expanding the game in the process.

There are over 1,000 locations, including a cloud-based kingdom reached by hot-air balloon, computer-generated mobiles which have artificial intelligence, plus numerous extra commands. Presumably the most important one is still F for Flee.

The new version can handle 100 players at once, and is available at the more sociable hours of 6p.m. to 8a.m. weekdays, and all day at weekends.

Drawbacks? Where Essex University let you play free, BT charges from £1 to £2 per hour, and to start you have to buy a Mud Pack for £20. Also, where Essex was on PSS, the BT version is only available via voice lines at 300 baud. This makes it even more expensive if dialling long distance, though a PSS node is planned.

Those signing up before 5 November get unlimited free play up to that date, when the service goes commercial for real. Details on 01-608 1173.

Build your own email

YOU CAN BUILD your own electronic mail system for £150, says *Practical Computing*'s sister magazine, *Electronics and Wireless World*. The hardware diagrams were published in the September issue, following an introduction the previous month.

The black box is plugged into a telephone socket and a micro with an RS-232 interface. The box contains 64K of RAM and a 1,200 baud modem. It permits three classes of mail: messages sent immediately; messages stored for transmission later; messages sent only when the destination unit makes contact.

The problem is not knowing with whom to communicate. However, the system offers a cheap option for multi-site businesses who need an error-proof high-speed duplex data link between a computer and a remote terminal or another computer.

Apparatus connected to the PSTN (public switched telephone network) in the U.K. requires approval from the British Approvals Board for Telecommunications (BABT). This hasn't got it.

SHORTS

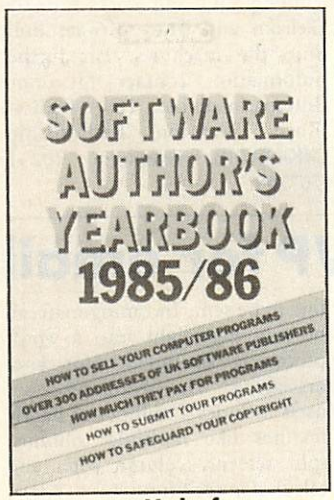
- Want to learn assembler on the IBM PC? QA Training is offering four- and five-day courses for the 8088 and 80286 in Cirencester. Prices are £480 to £520 plus VAT. Telephone: (0285) 69173.
- Staticide screen wipes, fluids and sprays have been launched by Hellerman Electric. As well as preventing static charges from building up on screens and disc boxes, you can also add it to your wash. Tel: (0752) 701261.
- The first national exhibition on Industrial and Commercial Applications of Artificial Intelligence will be held at Kensington Town Hall, London, on 21-23 October. For details of the accompanying conference telephone 01-277 1929.
- Specsoft has launched a 300 baud bulletin board aimed at the computer trade, to offer services, job information, software demonstrations, etc. The BBS is based on the Fido-net system which runs on IBM PCs. The 24-hour phone number is (0903) 39290.

BOOKS RECEIVED

Software Author's Yearbook 1985/6, edited by Liz Cooper. Published by Papermac, £6.95. ISBN 0 333 38882 8. One-third advice, two-thirds a list of British software houses and their requirements. Useful.

Databases by Peter Laurie. Published by Chapman and Hall/Methuen, £8.95. ISBN 0 412 26380 7. Down-to-earth if somewhat idiosyncratic guide to managing information.

Computers and Communication by R A Steele and J J Wellington. Published by Blackie, £5.95. Intended as a school textbook for CSE and O-level computer studies courses, but wide-ranging enough to interest any beginner.



Computer Help for Disabled People by Lorna Ridgway and Stuart McKears. Published by Souvenir Press, £5.95. ISBN 0 285 65009 2. A very detailed and practical guide, which is well illustrated, not over-technical and sometimes moving.

Atari 520ST update

IN LAST MONTH's issue we reviewed an Atari 520ST that didn't work very well. Atari replaced it with another sample which has now worked perfectly for a month. Software in use includes TOS, Logo, Gem Draw and a screen editor from Metacomco. BOS, Basic and Gem Write have yet to appear.

Samples of the 520ST have gone to selected customers in limited numbers. Some of them are user-group members and known Atari fans; others include about 50 educational establishments.

Atari has released names of software houses writing for the 520ST. They include Accounting Software, English Software, GST, Llamasoft, Computer Concepts, Glentop, Intelligent Software, Metacomco, Microdeal, Paradox, Softek, Mirrorsoft and Prospero.

Audiogenic has launched a version of its popular Swift spreadsheet, well known on the Commodore 64, which can use the extra RAM in the 130XE.

Contact Atari on (0753) 33344. Contact Audiogenic on (0734) 664646. PC

The Next Two Pages Could Change Your Life ....

At Ampex we've created two new terminals which offer advanced emulations, editing and ergonomics at prices our competitors just can't believe. (Some get fairly near our features but nowhere near our prices).

Others can match our prices but their features are limited. How about the Ampex 210? You can see it looks good. But can you also see the way its 14" amber screen tilts and swivels into the most comfortable position?

It has a detachable low-profile DIN standard Selectric-style keyboard whose slope you can adjust. It is beautifully styled and superbly engineered inside and out (otherwise it wouldn't carry the Ampex name).

It has 7 resident national character sets, 14 program function keys and an 80-character status line. With line graphics and a bidirectional printer port as standard. So too are the local editing and block mode transfer capacities to speed up work flow.

But here's where our competitors wonder what's hit them. **The Ampex 210 gives you 16 resident emulations at the touch of a key.** And all for the price of an ordinary terminal.

MORE PROLOG VERSIONS

PROLOG is now available for the Commodore 64 and Apple II, while a new version of the language with Macintosh-style windows and pull-down menus has been released for the main MS-DOS machines.

Prolog is the language brought to fame by the Japanese, who have adopted it for their fifth-generation artificial-intelligence research project. It is also increasingly being used commercially, mainly for the development of expert systems and database programs. Prolog systems are usually rather expensive, but the new implementations from Logic Programming Associates represent a major price breakthrough.

LPA micro-Prolog for the Commodore 64 costs £69.50 plus VAT, while the Apple version costs £85 plus VAT. Both versions are supplied on disc, and come with an introductory book on the language called *Programming in Logic* by Clark and McCabe as well as a manual. Acorn is expected to announce a BBC implementation of the LPA product shortly.

The new 16-bit version is called micro-Prolog Professional, and runs on machines such as the IBM PC, Apricot and RML Nimbus. It is faster than previous versions, supports MS-DOS 2 features, and includes a full set of primitives for building windowing applications. Micro-Prolog Professional costs £350 plus VAT.

For more details contact Logic Programming Associates Ltd, Studio 4, The Royal Victoria Patriotic Building, Trinity Road, London SW18 3SX. Telephone: 01-871 2016.

Ashton-Tate announces dBase deal

ASHTON-TATE has announced that it is taking over Multimate, the owner of what is probably the best-selling IBM word processor.

The deal should be completed by the end of the year, and will probably make Ashton-Tate the number 3 independent micro-computer software company in terms of revenue — quite close to Microsoft at number 2 but still a long way behind Lotus.

The Ashton-Tate product line-up will then include its original dBase II, now primarily targeted at the still quite active eight-bit CP/M market, and dBase III, Framework and Multimate, aimed at the much larger MS-DOS/PC-DOS universe.

According to reports in the American news weekly *Infoworld*, Ashton-Tate does not intend to totally ignore Macintosh users either. Apparently Wayne Ratcliff, the original author of dBase II, is developing a version of dBase III for the Apple machine.

The company has also acquired rights to a Mac database product developed by Digicorp, a Salt Lake City software company.

Wide display for lap portables

T-VIEW 80 allows you to display up to 80 columns of text on a standard Tandy 100 or NEC PC-8201A lap portable. Both these battery-powered computers have liquid crystal display screens which normally show eight lines of 40-column text.

T-View 80 is a machine-code program which fits into a small quantity of memory, and then generates its own, more compressed character set. This allows you to fit 60 columns across the screen at a time: if you need more width T-View 80 lets you scroll an additional 20 characters.

The program costs £46 including VAT and works with the Telcom and Text software built into the machines. For further information contact Microtime International Ltd, 106A Bedford Road, Wootton, Bedfordshire MK43 9JB. Telephone: (0234) 767758.

Telewriter WP for email

TELEWRITER is the latest product from Bristol Software Factory, better known for its integrated package Silicon Office. It provides a closely integrated word-processing and electronic-mail package designed to protect the user from some of the barbarisms of mail systems such as Telecom Gold.

As well as providing word processing Telewriter allows facilities like autodial can be called up with a single command, allowing documents created off-line to be sent. Incoming mail can be routed straight into a word-processing documents for later massaging. The word processor itself includes a number of handy features like multiple columns, split screens, column sorts and calculation facilities.

Telewriter is available for a wide range of MS-DOS machines and costs £295 plus VAT. Details from Bristol Software Factory Ltd, Thornton House, Richmond Hill, Clifton, Bristol BS8 1AT. Telephone: (0272) 735022.

dBman aims to rival dBase II

dBMAN is a fast database-management system based on the dBase II command language. Written by Versasoft in the U.S., dBman claims several advantages over its well-known rival, principally very fast multi-field indexing.

The program runs on the IBM and MS-DOS machines such as the Apricot and costs £395 for the full version, or £25 plus VAT for a demo disc. Contact dBman U.K. Ltd. Telephone: (0279) 722261.

Accounts teaching

RESEARCH MACHINES can now supply schools and colleges with a training version of the popular Pegasus accounting package. Running on RM's Nimbus machine, Educational Pegasus covers invoicing, stock control, payroll and all the main ledgers, and costs £295. Contact Research Machines Ltd, Mill Street, Oxford OX2 0BW. Telephone: (0865) 249866.

You can emulate the Tele Video 910, 910+, 912, 920 or 925* And the Lear Siegler ADM3, ADM3A, 3A+ or ADM5*

You can emulate the Hazeltine Esprit 1400, 1410 or 1500* the Qume's QVT 102* and the ADDS Regent 20, 25 and Viewpoint†

You want something even better? Try the Ampex 230. It's like the 210 with different resident emulations. But what makes the 230 special is an extra row of 16 programmable keys which effectively doubles its emulations to 32.

It has a 132-column display, a 400 byte double-page memory, 9 resident national character sets, and many quality features you only find on desperately expensive machines.
The Ampex 230 **has** everything. It lets you **do** everything.

There's more. In OEM quantities we'll customise the appearance and programming of either terminal to any specification.

*TeleVideo, Lear Siegler, Esprit and Qume are trademarks of TeleVideo Systems Inc; Lear Siegler Inc; Esprit Systems Inc; and Qume Corporation respectively.
†ADDS, Regent and Viewpoint are trademarks of Applied Digital Data Systems Inc.

Superscript

SUPERSCRIPT is a new word processor for 64K and 128K Commodore and Atari systems, such as the Commodore 128 and Atari 130XE. It has a built-in 30,000-word spelling checker, mail-merge, arithmetic and macro functions.

Superscript makes full use of the extra memory available on the 128K systems. On the Commodore 128 you can load Superscript into the memory alongside Precision Software's popular Superbase progam and use the same files.

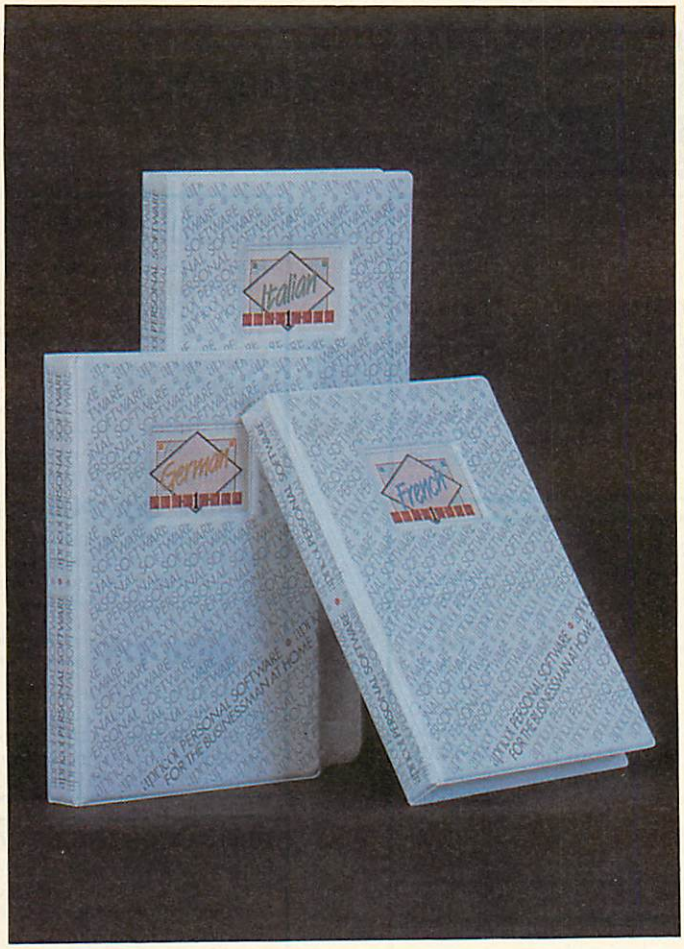
Superscript is supplied on disc and costs £79.95 including VAT on the Commodore systems, and £69.95 on the Atari 130XE and 800XL. A similar program is available for Apple II machines. Contact Precision Software Ltd on 01-330 7166.

Laserbase

LASERBASE is a British-written database for the 128K or 512K Mac. Its main claim to fame is ease of use and the ability to handle variable field and record sizes. Laserbase costs £130 plus VAT and will work with Apple's new Switcher operating-system utility. Contact Laser Software on (0442) 827933.

Apple stats pack

STATSTREAM for the Apple II is aimed at statisticians and students. It has a library of 76 procedures, which can be called directly or incorporated in Basic programs. Statstream is supplied on disc and costs £66 including VAT. Contact Elsevier-Biosoft, 68 Hills Road, Cambridge CB2 1LA.



Foreign-language teaching packages

INTERMEDIATE-LEVEL French and German courses for the IBM PC and Apricot are the most recent additions to the Gruneberg Linkword range of foreign-language teaching software. The company has also recently added Russian, Portuguese, Greek and Dutch to its more basic vocabulary- and grammar-teaching range, which is available for the Apple II, Apricot and IBM PCs.

The basic-level courses are aimed at business users who want to pick up a 400-word vocabulary and the essentials of grammar in a hurry. Each course costs £29 plus VAT and comes with an audio tape to help pronunciation, as well as a program disc.

The two new intermediate-level courses teach a far more extensive vocabulary and each cost £39. More details from Access Software, 100 Baker Street, London W1M 1LA. Telephone: 01-935 1470.

SOFTWARE SHORTS

Mac C is a true C compiler for the Macintosh, producing directly-executable 68000 code. It supports all the usual features of the Mac interface and costs £295 plus VAT. Contact P&P Micro Distributors Ltd, Todd Hall Road, Carrs Industrial Estate, Haslingden, Rossendale, Lancashire BB4 5HU. Telephone: (0706) 217744.

Blitz is a Basic compiler for the Commodore 64. Supplied on disc, Blitz costs £49.95 including VAT and is available from Supersoft. Telephone: 01-861 1166.

White Knight Mk 12 is a strong new Chess program for the BBC Micro. It has a British Chess Federation rating of 156+ and is quick. White Knight costs £18.95 including VAT on disc and is available from BBC dealers. Or contact BBC Publications, PO Box 234, London SE1 3TH.

Turbotool 50 for the Commodore 64 is a utility ROM which provides fast cassette loading, a large number of extra Basic commands and a machine-code monitor. It is supplied on cartridge and costs £39.95 including VAT. Contact Robcom on 01-209 0118.

Ensemble is a French-written package for the 128K or 512K Mac which integrates database, text processing, report generator and graphics. The product does not include a proper spreadsheet facility and is probably best suited for report-writing and mailing applications. Ensemble costs £255 plus VAT from Softsel dealers. Telephone: 01-568 8866. PC

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Epson DX100 Daisywheel	£399.00
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Centronics Horizon H80	£375.00
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QX-10 Colour Desktop Computer	£1750.00
HX-20 Portable Computer	£345.00

apple

Apple IIc 128K RAM 80 Col	£940.00
Apple IIe 64K Computer	£499.00
Apple Disk Drive with Controller	£225.00
Apple Disk Drive without Controller	£199.00
Apple Extended 80 Column Card	£185.00

IBM ACCESSORIES/SOFTWARE

Persyst SB64 Multifunction Board 256K RAM	£275.00
Persyst SB256 Multifunction Board 256K RAM	£375.00
Microvitec Colour Monitor Med Resolution	£390.00
Microvitec Colour Monitor High Resolution	£469.00
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Lotus 1-2-3	£329.00
Symphony	£449.00
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Apricot add-ons

THE NEWLY NAMED Apricot Computers has announced new file servers for its network, based on the F10 micro reviewed on page 67 of this issue. The Apricot 32/10F has 512K of RAM, a 10Mbyte Winchester and a 720K floppy. Each file server can work with up to 16 work stations. The 32/10F costs £1,995.

Apricot has also announced a combined network and 256K RAM expansion card costing £395, and a stand-alone 10Mbyte Winchester unit, the MX-10, for £995. Details on all these products on 021-501 2284.

68020 micro

IMP has announced the first British-designed and built micro based on Motorola's top-of-the-range 68020 chip. The IMP Mentor is not cheap, weighing in at £25,000, although a cut-down version using a 68000 is available for £12,500. But for this price you get a machine capable of handling 32 users simultaneously under Unix. The Mentor also has two 68000s to handle disc operations and I/O. Details on (0207) 503481.

VIENNA AOC

NORTHERN TELECOM has launched an IBM PC/AT compatible machine as a follow-up to the Vienna PC system reviewed in August's *Practical Computing*. As well as being the first AT-alike designed and manufactured in Europe it also offers the possibility of running Xenix 286. This facility is so far lacking on the IBM machine.

The entry-level system costs under £4,000, and offers 512K RAM, a 20Mbyte Winchester, a 1.2Mbyte floppy and serial and parallel ports. A keyboard is £315 extra, and monitor adaptors start from £181. Upgrades available include a 80287 co-processor, a RAM upgrade to 640K, and a 32Mbyte Winchester.

A version will be available next year with the high-resolution white screen which was such a striking feature of the Vienna PC. In addition, it will be able to run all the Vienna Office software as well as PC/AT applications.

Under Xenix, which will cost £450, up to five users can access a maximum of 7Mbyte of RAM; the maximum hard-disc capacity will be 240Mbyte. Northern Telecom is on (05827) 63161.

Amstrad WP system

AMSTRAD has launched the PCW-8256, a complete word-processing system for £399 plus VAT. The machine has a Z-80A running at 4MHz under CP/M Plus, 256K RAM and a built-in 3in. drive with 180K formatted storage per side. Also included is a 90-column by 32-line screen, and a printer offering 20cps NLQ and 90cps draft speeds. There is a full QWERTY-layout keyboard with additional dedicated function keys.

Bundled software includes the custom-designed Locoscript word processor, CP/M Plus with GSX and DR Logo, and a new Basic, called Mallard Basic. Expansion options include an RS-232 and Centronics interface, and a second 720K formatted capacity disc drive. Units should be available in High Street outlets now.

Meanwhile, Amstrad has already started shipping its 128K RAM CP/M Plus, the 6128. For the monochrome model the price is £299, and for the colour model £399. The 664 has been quietly dropped. Amstrad is on (0277) 228888.

TDI Pinnacle XL

TDI has launched an upgrade of its multi-user Pinnacle p-system machine. The Pinnacle XL has two 68000s, one for processing, the other for disc accessing and serial ports. As a result, TDI claims the XL can handle 16 users at typical PC speeds. A basic 16-user system with 2Mbyte of RAM, a 43Mbyte Winchester and a tape streamer costs £14,395. This excludes the cost of terminals as existing micros or terminals can be used. Details on (0272) 742796.

HARDWARE SHORTS

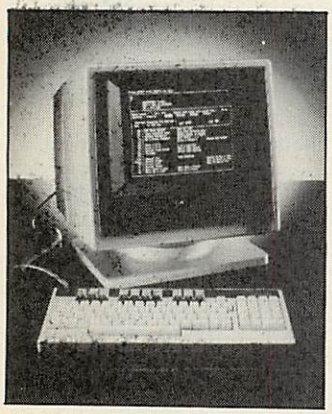
- Commodore has announced the price of its 128 machine as £269. It is being launched together with a faster disc-drive unit. Details from Commodore dealers.
- A switchable RS-232/Centronics interface for the Canon laser printer has been produced by Norbrain Data. The price for a complete system is £3,029. More on (0734) 864411.
- The price of the Tandy 200 lap portable has been announced as £795. The built-in modem still lacks BABT approval. Details on (0922) 648181.
- ACT Holdings plc, the holding company for the ACT computer group, has changed its name to Apricot Computers plc. This mirrors a similar change in most of its subsidiaries' names.
- Enterprise has produced a CP/M look-alike for the 64/128. Cost is about £100. More on 01-739 4282.
- Acorn's BBC B+ has been revamped by Oak Universal as the Oak Personal Computer. For £1,325 it offers built-in double disc drives, Z-80 processor and software. More on (0274) 614167.
- Sinclair-endorsed 720K microfloppies for the QL are available from Micro Peripherals Ltd. The cost is £258 for the first drive and £139 for subsequent ones. Details on (0256) 461570.
- Epson has reduced the price of its RX-100+ and FX-80+ printers by at least £50. More on 01-902 8892.
- A £66 Olivetti 5.25in. 100K disc drive is available for the BBC Micro from RCS Computer Services. Details on 01-844 1333.
- Acorn has gone into the chip business with a 32-bit reduced instruction set processor called the Arm. More on (0223) 323302.
- Sanyo has reduced the price of its MBC-555-2 to £1,190 from £1,390; the MBC-775 transportable now costs £1,990 instead of £2,150. Details on (0973) 46363.
- DK'Tronics has announced the Amstrad Graphics light-pen. The cost is £24.95. More on (0799) 26350.

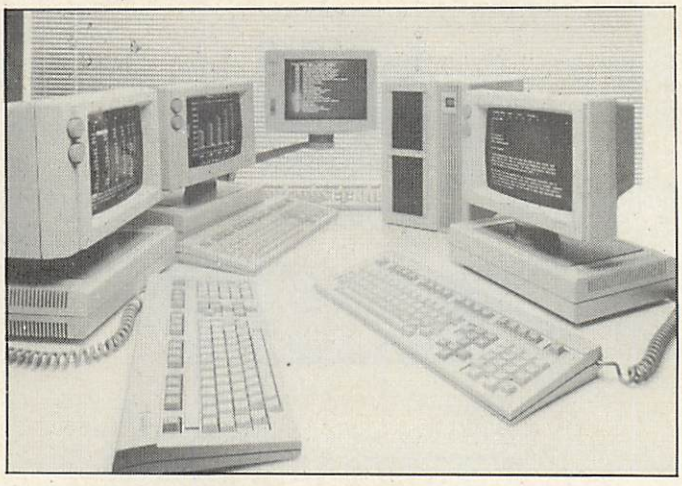
(More news on next page)

Acorn Cambridge Processor

ACORN has announced a number of machines based around the National Semiconductor 32016 running at 8MHz, aimed at the scientific and engineering markets. There are two basic models: the Co-Processor system reviewed on page 68 of this issue, and the Cambridge Workstation.

Prices for the Workstation start at £3,595 for a 1Mbyte RAM disc-less unit with mono screen, progressing up to £7,895 for 4Mbyte of RAM, a 20 Mbyte hard disc, a 640K floppy and colour screen. More information on (0223) 245200.





Wang's APC

WANG has chosen the Intel 80286 chip to power its new Advanced Professional Computer. The machine is based on Wang's existing PC, which can be upgraded to an APC for about $2,000 by changing the motherboard.

The APC has 512K of RAM, which can be expanded to 2Mbyte on the motherboard. Disc options include 360K and 1.2Mbyte floppies, and 20Mbyte, 30Mbyte and 67Mbyte hard discs.

The APC can be run under MS-DOS, or as a multi-user system with four terminals under Xenix. Compatibility with the Wang PC means the APC is not compatible with the IBM PC/AT unless you add Wang's IBM Emulation Card.

Wang is also planning to offer Wang word processing for IBM PC owners. The software, a Wang-style keyboard and LAN con—nections, will enable Wang VS minicomputer users to hook IBM PCs into their systems.

Contact Wang (U.K.), 661 London Road, Isleworth, Middx TW7 4EH. Telephone: 01-560 4151.

68008 for BBC and QL

CUMANA has announced the Upgrade, a 68008 add-on for the BBC and QL allowing the OS-9/68000 operating system to be run. It also provides 512K RAM, a disc controller, SASI Winchester interface and internal clock.

OS-9 is a multi-tasking operating system with Unix-like operation and appearance. Also included with the package is C, ISO Pascal and an assembler and Basic compiler. Software is currently under development to allow both the BBC and QL to use the extra RAM, even when not operating under OS-9. The BBC version costs £695, and the QL around £800. Details on (0483) 503121.

Amstrad network

NORTHERN COMPUTERS is producing a network for the Amstrad computer, based on the ring topology Simple Net from Nine Tiles. Up to 125 nodes can be hooked up together; the wiring is simple twisted pair. The cost will be about £150 for each interface. More on (0928) 35110.

Portable disc drive

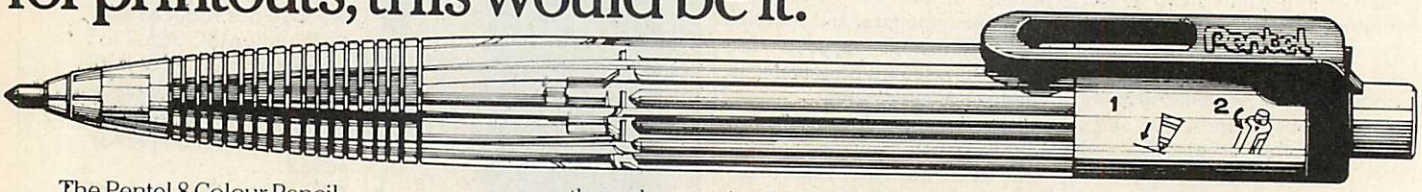
A BATTERTY-OPERATED disc drive for the three Kyocera lap portables has been launched by Microtime International. The 100K capacity unit weighs under 1kg. and costs £200.

Microtime has announced other products for use with lap portables. The Mac-In, a measure and count input device, has two input modes. One is a small wheel for measuring linear distances, the other is a ball-tip pen with a pressure contact switch for counting. The software lets you hook the device up to the bar-code reading port on the NEC 8201 and Tandy 100. The cost is £135.

The Big Wheel is a larger version in which the wheel is 40mm. in diameter. It costs £150. Under development is the Quantum Wheel, whose diameter will be larger still. Information on all these products on (0234) 767758. PC

Two ballpoint-size wands allow you to enter figures directly from, say, buildings plans to a micro.

If you asked a computer to design a coloured pencil for printouts, this would be it.



The Pentel 8 Colour Pencil.

Simply twist the barrel to select your colour and press the clutch mechanism at the top to advance the lead. Then use it to highlight information and make notes on printouts without a line, letter or figure soaking through, at a price that we're sure won't soak you.

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Pentel 8 COLOUR PENCIL

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- Ethernet controller as standard with 'Cheapernet'
- IBM PC compatible colour graphics option
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- 3 parallel ports, centronics compatible
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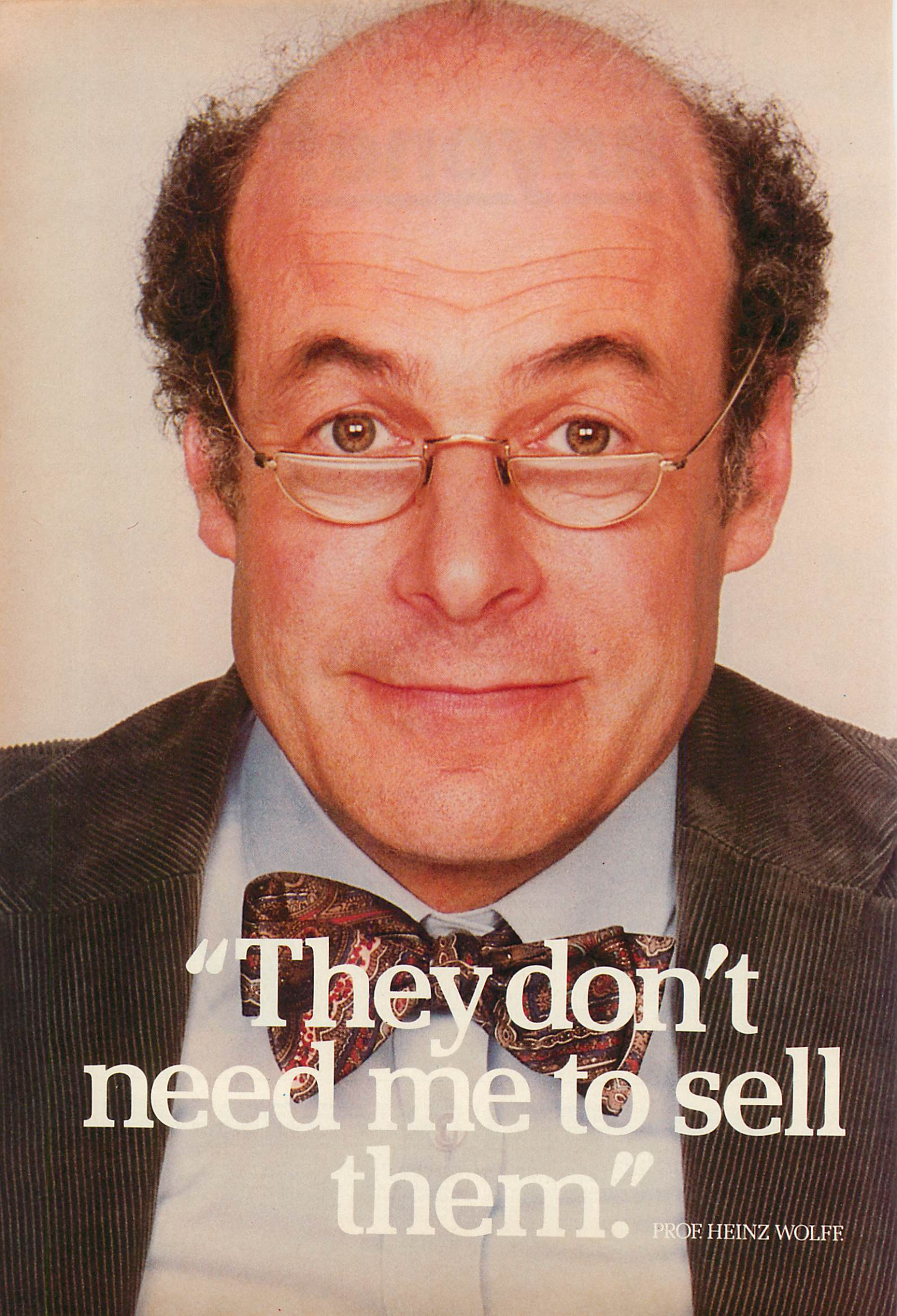
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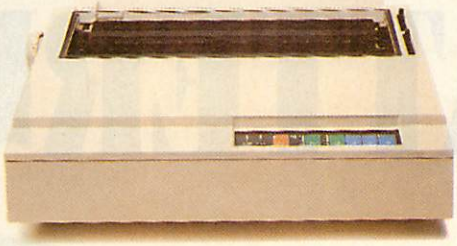

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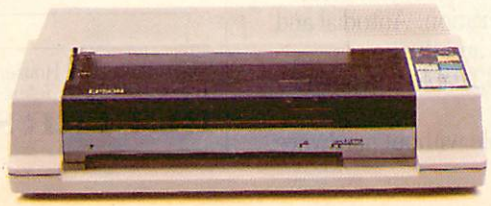

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Chit·Chat is a versatile data communications program that opens up a whole new range of possibilities. Data can easily be transferred, even between incompatible machines, either by direct cable connection, or by telephone, using a modem.

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The Chit·Chat Communications Pack at only £399+VAT, includes the Chit·Chat program, a state-of-the-art modem, specially made to Sagesoft specifications by Thorn-EMI Datatech. No knobs or switches, just sleek good looks and simple, error-free operation. Autodial and autoanswer facilities are incorporated and the unit is entirely software controlled. An RS232 cable and power pack are included in the package.

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PC 10/85

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BY RAY COLES

RALLY TO THE COLOURS

With its new colour look-up table RAM Inmos gives patriotic Brits something to cheer about.

It can be a bit worrying at times, when you stop to think about the sate of British semiconductor technology. The country that gave the world the steam engine, the jet engine and the synchronous communication satellite, now seems to be a complete duffer when it comes to the very essence of 1980s technology, the development of advanced integrated circuits.

The British seem to be quite good at inventing things, especially when the invention can be successfully carried through by an eccentric individual or a small team with limited facilities. Where the British come unstuck is in turning bright ideas into profitable products.

Of course what it really all boils down to is money, or rather, a lack of it for investment in good ideas. The trouble is, in Britain there is little public enthusiasm for the technology itself. Microchips, like Big Macs, are distrusted as an American imposition, and regarded as quite unseemly in a country still wedded to real ale — served warm.

QUAINT

As an unashamed technology freak I am saddened by this annoying British trait. It will eventually result in the British being relegated to the role of international curiosities. Soon Britain will be merely a stopping-off point between Tokyo and New York. As I leaf through piles of press releases, each extolling the virtues of the latest whizz-bang devices from Japan, the U.S., France, Germany and Italy, I search frantically for a real home-grown item. Alas, I search in vain. Hand-made furniture and organic vegetables are in, but world-beating chip designs are out. Or so it was beginning to appear.

There is, however, a new device from Inmos, the very innovative and almost entirely British semiconductor manufacturer. Inmos was originally launched with the help of some massive cash injections from a surprisingly generous British taxpayer. This probably arose because a soporific under-secretary decided that anyone based in Bristol and using a name like in-moss must be linked with a solid, dependable, industry like horticulture.

Inmos has introduced some excellent products in its short existence, including some very high-performance memory devices and the ingenious Transputer. When I covered the Transputer launch last year, I expressed an interest in obtaining a few Inmos shares myself. However, Thorn EMI beat me to it, relieving the British taxpayer of this heavy burden just as things were starting to get interesting.

I sat back and waited for Thorn EMI shares to take off, but about this time the stock exchange seemed to find out that Inmos wasn't anything to do with flower arranging or peat bogs after all. Actually it involved the manufacture of semiconductors and Thorn EMI shares took a heavy pounding as a result.

TRANSPUTER LAUNCH

But despite this setback Inmos has persevered. The amazing Transputer, which is now renumbered the T414, and minus a few bells and whistles, will be relaunched as an available product in the autumn. As long as Thorn EMI shareholders can be kept under the impression that the Transputer is a device for unblocking sinks, and not a microprocessor at all, then the launch should go very well.

In the meantime, to keep engineers happy, Imnos has introduced some other new devices. These inlcude a family of 256K CMOS dynamic RAMs and, most recently, the ingenous IMS G-170 colour look-up table. A quick skim through the data sheet on the IMS G-170 has convinced me that British can still mean best after all.

Back in April I reported on the latest high-resolution colour-graphics chip set from the U.S., the AMD 8150 video-shift register, the 8158 video-timing controller and the 8151 colour palette. To build a complete colour graphics system, three AMD 8151 colour look-up tables would be required, one for each of the three primary colours. If you use the new Inmos device you can do the whole job with just the one device, and save some money into the bargain.

Colour look-up tables are required because even with standard colour monitors, the range of available colour hues which can be generated by mixing appropriate proportions of red, green and blue is enormous. To cover anything like the full range of possible hues, at least six bits per colour channel are required, demanding the storage of 18 bits per pixel and there are 256K pixels on a 512- by 512-pixel resolution screen. Memory is getting cheaper of course, but even so, the requirement to manipulate 18-bit colour words could throw a debilitating burden on the processor.

The colour look-up table provides an easier approach by limiting the number of instantaneous colours to only 256, which can be represented by a more manageable and convenient eight-bit word. The look-up table is actually a memory array containing 256 locations, each holding the definition for a particular hue, 18 bits in the case of the G-170.

FULL RANGE

If the look-up table is held in ROM — as it could be — then the designer has to choose the required 256 colours from the range of 262,144 available in the palette. But if the memory array is read/write RAM as it is in the G-170, then the look-up table can be redefined by the programmer whenever necessary, and access to the full palette can be obtained.

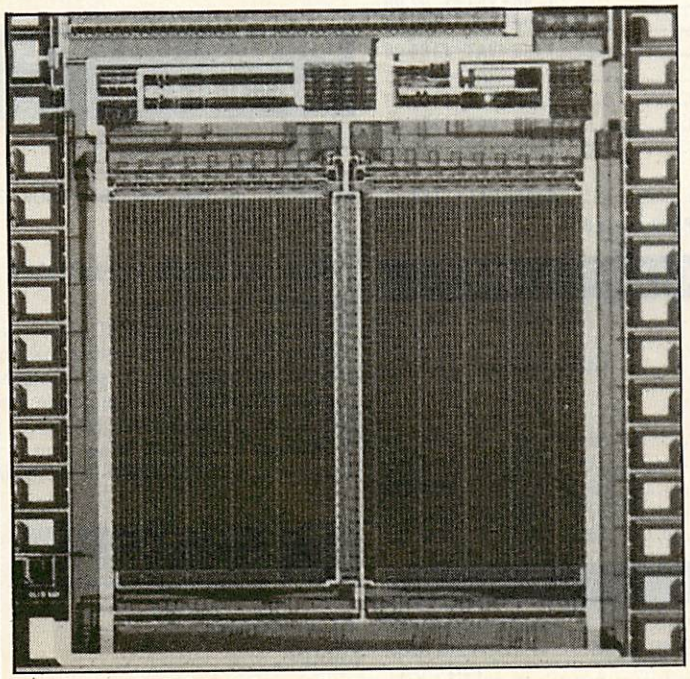
Inmos has used its high-speed 1.75 micron CMOS process to produce a 256 by 18 look-up table array with an access time of only 20ns., which is fast enough to handle a 50MHz dot clock. And Inmos has not stopped at the memory. The G-170 also includes three six-bit digital to analogue converters which are needed to drive the three separate colour channels of the RS-170A video standard, and a pipelined microprocessor interface which allows the table to be reload without any disruption of screen-refresh operations.

To reload a pixel location in the table, the microprocessor loads an eight-bit pixel address and three data bytes into registers within the chip. A memory write cycle is then automatically inserted into the internal pipeline so that when the next screen-refresh operation has been completed the new pixel data can be loaded into the array.

Also available on the chip is a pixel mask register which can be reloaded via the data bus. The mask data is Anded with the incoming pixel data and can be used to divide the available palette up into separate areas which can be accessed individually by rewriting the mask data.

This useful facility can be used for animation by displaying an object stored in one video RAM area while updating it in another, and then switching between them using the mask. Instant colour changes are also possible using this facility.

The IMS G-170 comes in a 28-pin ceramic package, dissipates less than 600mW, and is British to the core. PC



Die photograph for the Inmos G-170.

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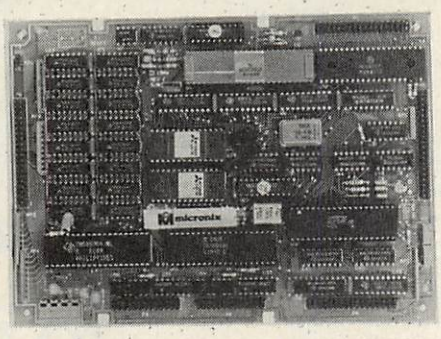

★ 68008 8 MHz CPU ★ 128 RAM (expandable to 256K) ★ Up to 64K EPROM 1 Floppy disk controller for 5¼", 3", 3½" drives ★ 2 RS232 serial ports ★ Mounts directly on 5¼" drive ★ 2 × 8 bit parallel ports ★ Full debug monitor with single line assembler and disk loader ★ Expansion bus ★ Power requirement: +5V/1.5A, +12V/100mA, -12V/100mA.
Available as a Bareboard with Monitor ROM and IFL Chip Set £199 + VAT = £228.85 or completely assembled £499 + VAT = £573.85 128K Expansion Board (recommended for OS9/68000) £199+VAT=£228.85 – OS9/68000 real time, multitasking, multiuser Operating System (similar to UNIX) £300+VAT=£345 C Compiler, BASIC 09, PASCAL and FORTRAN available. ESB-MATE with 512K RAM, 2 serial, parallel, clock £399+VAT

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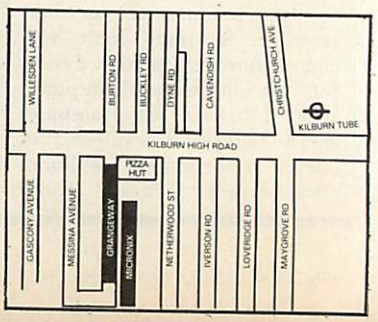

● Circle No. 161

BY MIKE LEWIS

A GOOD FIND

There are a number of elegant methods for finding a specified string within a text file.

Of you were to ask a cross section of WP users to name the feature of their editor that they would most hate to lose, the majority would probably nominate the Find command or its equivalent. Searching a text file for a given word or phrase is not only very useful, it is also extremely simple to implement. Any software author worth his or her salt should be able to code a pattern-matching routine in just a few instructions, even in assembler.

What is much more difficult is to implement a search that will run faster than a brute-force character-by-character comparison. The normal searching algorithms — hash tables, binary searches, trees and the like — will not do the job because they depend on a pre-imposed structure, something which is inevitably absent from free-format text files.

BRUTE FORCE

There are techniques for speeding up string searches, but before looking at them, it is worth recapping the brute-force method, if only to establish the terminology. Suppose that the text file and the search pattern are both held in arrays of characters, respectively called TXT and PTN, of length N and M, and accessed by pointers i and j.

The search starts by comparing the first character of each array — that is, with i equal to 1 and j equal to 1. If they match, both pointers are incremented and the process is repeated. When a mismatch occurs, i is set to one more than its previous value

$$i=i-j+2$$

and j is set equal to 1 again. This is repeated until either j is greater than M, in which case a match is found, or i exceeds N, indicating that the search has failed. This brute-force method is shown in listing 1, which I have coded in Pascal.

The problem with this technique is that, because it is sometimes decremented, some text characters have to be examined more than once. This is especially true if you are searching for a string that nearly matches a common pattern of text. If the searched-for word is "thesis", for example, i will be decremented every time the search reaches a word like "the" or "these", thereby slowing things down.

A better method was proposed in 1976 by Knuth, Morris and Pratt, as an algorithm which bears their name. Its aim is to elminate the decrementing of i by taking advantage of the pattern of characters within the search argument. A good example of this is the case in which the first letter of PTN is not repeated in PTN. When a mismatch occurs, the previous j – 1 characters of TXT can be ignored, because these are guaranteed not to match the first j characters of PTN. So the comparison from PTN(1) is resumed without altering i.

Furthermore, if PTN starts with a repeating sub-pattern, you do not even have to go back to j equal to 1, but only to the point immediately after the final occurrence of the sub-pattern. If the searched-for string is "robroy" and a mismatch is found at any of the first three lettters, the search resumes from PTN(1) as before. But if the search gets to the second "r" or "o", the next comparison can be with j equal to 2 or 3 respectively. In each case, the value of i is never decreased.

For any search pattern, it is possible to set up a small array to show where in the pattern — that is, at which value of j — to resume comparisons after a mismatch. The contents of the second element of the array would be used if the match failed on the first character, the third element for the second character, and so on. Array element number 1 always contains zero. So for "robroy", the table contains 0, 1, 1, 1, 2 and 3. Listing 2 shows the algorithm in action.

Of course, before you can use this routine, you have to set up the table, but this is a small overhead if the text is large. A neat way of doing this is to use the search routine itself, adapted to search for the first j characters of the pattern in the rest of the pattern, that is from the second character onwards. This is illustrated in listing 3.

The Knuth-Morris-Pratt algorithm is not the easiest technique to understand, and the original paper describing it is also hard to follow. You can find a clearer explanation of the details in Robert Sedgewick's excellent book *Algorithms,* published by Addison-Wesley, 1983, on which all the listings used in this article are based. Dry running the routines on paper will also give you a better insight.

Although the technique will provide significant time savings in only a limited number of cases, it has a major advantage where the text cannot be held entirely in RAM. Because the text pointer is never decremented, you never have to move backwards through the text, so avoiding the awkward buffering that plagued many early text editors. It was the need to solve precisely this problem which spurred one of the authors, J H Morris, into perfecting the algorithm.

PATTERN MATCHING

A faster pattern-matching technique, but one which does involve going backwards through the text, was developed by R S Boyer and J S Moore in 1977. Unlike the other methods described here, it involves scanning the pattern from right to left. The easiest way to understand it is to work through an example.

Suppose that the text to be searched consists of the sentence:

Use your tab key to enable entry of tables

and that the search pattern is the word "table". The search starts by aligning the pattern against the first M — which in this case is 5 —

(continued on next page)

LISTING 1

```
function search1: integer;
        {Brute force search. Returns pointer to the char.
        following the match, or to end of text if no match found;
        text to be searched is in array txt, of length N;
        pattern is an array ptn, of length M}

  var i,j: integer;

  begin
    i:=1; j:=1;
    repeat
      if txt[i]=ptn[j] then
          begin i:=i+1; j:=j+1 end
      else
          begin i:=i-j+2; j:=1 end;
    until (j>M) or (i>N);
    if j>M then
      search1:=i-M
    else
      search1:=i
  end;
```

LISTING 2

```
function search2: integer;
        {Knuth-Morris-Pratt method. Returned values and array
         names as in previous example; back is an array of
         integers of length M}

  var i,j: integer;

  begin
    i:=1; j:=1;
    repeat
      if (j=0) or (txt[i]=ptn[j]) then
          begin i:=i+1; j:=j+1 end
      else
          begin j=back[j] end;
    until (j>M) or (i>N);
    if j>M then
      search2:=i-M
    else
      search2:=i
  end;
```

LISTING 3

```
procedure setupback;
        {intialises the array for KMP algorithm}

  var i,j: integer;

  begin
    i:=1; j:=0; back[1]=0;
    repeat
      if (j=0) or (ptn[i]=ptn[j]) then
        begin i:=i+1; j:=j+1; back[i]:=j end
      else
        begin j:=back[j] end;
    until i>M;
  end;
```

(continued from previous page)

characters of the text, the string "use y". Now compare the last character of the pattern, e, with the corresponding text character, the y in "your". This is a mismatch but, more to the point, the y does not occur anywhere in the search pattern. So we can, as it were, slide the entire pattern past these first j characters.

The last letter of "table" is now lined up against the t in "tab". This is also a mismatch, but in this case the pattern slides only four places to the right, so that the current text character matches the t in the pattern. Once again, we resume the comparison with the pattern's rightmost character, now lined up with the k in "key". This does not occur in "table", so we can slide five more places.

Two further iterations will bring us to the b of "enable". Since this letter occurs in the pattern, the next shift is only two places. We now have a match with the rightmost letter. So we work backwards through both text and pattern, eventually finding a mismatch with the n. Another three shifts brings the last character of the pattern against the e of "tables". Stepping backwards once again we discover that there is a match between all the characters, so the search is now complete.

This method owes its speed to the fact that it moves through the text with large strides. The text pointer, i, is decremented only in the relatively rare case of a match being found. More often than not it is incremented, usually by a value equal to the length of the search pattern. But at first glance, it looks as if this advantage is cancelled by the constant need to work backwards through PTN to see if the mismatched character of TXT occurs there. However, this can be avoided by once again setting up a small array in advance.

Assuming that the text can contain any ASCII character, we will use an array of 128 elements, one for each ASCII code. The table will tell us, for each character, the amount to increment i whenever that character occurs in the text and results in a mismatch. If the search argument is "table", the value in the array for e is 0, 1 for l, 2 for b, and so on. For characters absent from the pattern, the value is M, the length of the pattern. If a character appears more than once, we take its value from its rightmost position.

Listing 4 shows the Boyer-Moore algorithm, and listing 5 is the short routine to set up the array. The Ord function is found in some versions of Pascal, including Turbo Pascal which is used here. It returns the ordinal value of any scalar variable, and so provides a convenient way of obtaining a subscript to the array for any character.

As with Knuth-Morris-Pratt, the overhead of setting up the array is insignificant compared with the searching time. It is virtually impossible to compare the running times of the two algorithms, because they depend so much on the nature of the search patterns, but Boyer-Moore would probably do better more often than not. Not surprisingly, it is the algorithm of choice for writers of word processors and text editors. PC

LISTING 4

```
function search3: integer;
        {Boyer-Moore algorithm. Returned values, txt and ptn
        arrays, etc. as before; skip is an array of 128 integers}

  var i,j: integer;

  begin
    i:=M; j:=M;
    repeat
      if txt[i]=ptn[j] then
        begin i:=i-1; j:=j-1 end
      else
        begin i:=i+skip[ord(txt[i])]; j:=M end;
    until (j<1) or (i>N);
    search3:=i+1
    end;
```

LISTING 5

```
procedure setupskip;
        {initialises the array for BM algorithm}

  var j: integer;

  begin
    for j:=0 to 127 do
       skip[j]:=M;
    for j:=1 to M do
       skip[ord(ptn[j])]:=M-j
  end;
```

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2

BY DAVID LEVY

BLACKJACK

A system to help you win at this favourite casino card game.

When I was at school we played a card game called pontoon whose object was to score as close to 21 as possible. It was great fun, and we would bet very small amounts of money to make the game more exciting. When I went up to university my education soon included such essential subjects as four-card brag, stud poker and chemin de fer, and during my first long vacation I decided to explore the delights of Las Vegas — purely for educational purposes of course.

In Las Vegas I first came across a number of gambling games that I had previously not even heard of, one of which was blackjack. I watched the punters at the blackjack tables in a number of casinos, and noticed the similarity with my old-time favourite pontoon. However, in this case the game seemed to be much less advantageous for the dealer because his first card could be seen by all the other players before they had to decide whether to stand by taking no more cards, or draw by taking another card.

A SYSTEM!

I thought little more about blackjack at the time, but soon after my visit to Vegas I came across a fascinating book called *Beat the Dealer*, by Edward O Thorp. The author was and still is a Professor of Mathematics at the University of California, and it became clear from a quick glance at the book that he had discovered what every gambler dreams of: a system that actually works.

Blackjack is played with one or more standard decks of 52 cards. Before each hand begins a player must place his bet for that hand. The dealer, who works on behalf of the casino, deals two cards to each player and two — one face up, one face down — for himself. If the dealer's face-up card is an ace or a 10 count he looks at his second card, and if the total adds up to 21 he has blackjack, and wins against all the players who do not also have 21 in their first two cards.

Each player now adds up the pips on his cards: ace counts 1 or 11 at the player's choice; kings, queens and jacks count 10; and all other cards have their face value. The player tries to get as close to 21 as possible, but if his pip count goes over 21 he busts and loses his money.

The most frequent decision for the player to make is whether to stand — that is stop with what he has already got — or to draw by taking another card. The other principal options open to him are first, to split a pair if his first two cards are of equal denomination, which allows him to play two hands against the dealer, each at his original stake and each starting with the same card. Or, second, to double down, by doubling the stakes for that hand; after doubling a player draws one and only one more card before standing.

STAND OR BUST

If the dealer has 16 or less he must take another card; if he has 17 or more he must stand. If the dealer has an ace it must count as 11. If the dealer goes bust, all the remaining players, those who have not gone bust, win the amount of their stake. If the dealer does not go bust he wins the player's stake against hands which have lower scores, he loses the stake against hands which have higher scores, and gives back the original stake to players who have the same score.

If the dealer has blackjack, meaning he has an ace and a 10 or face card, giving him 21 in two cards, he wins the player's stake against anything other than another blackjack. If the player makes blackjack and the dealer does not, the player wins 1.5 times his original stake rather than the same amount as the stake.

When a hand is over the cards are not shuffled; the used cards are put in a separate pile and the game continues with the remainder of the original deck(s). This is very important because it enables the players to keep track of whether the remaining deck is favourable for them or not.

There are various forms of Thorp's system, and here I describe his basic strategy, which will give you a clear idea of what the system is all about, and should result in your achieving an advantage of 0.13 percent against the casino.

The strategy depends on knowing two things: how much to bet before a hand has been dealt, and when to stand, draw, split and double down. Thorp discovered that when the deck has relatively few high cards the situation is favourable for the dealer but that when there are relatively few low cards in the deck the player has the advantage.

In the simple strategy the decision on how much to bet is therefore made in accordance with a count that measures whether the remaining deck is good or bad for the players. You simply count + 1 whenever a low card is turned over, 11 whenever a high card is seen, and 0 for the middle cards — 7,8 and 9. If the point count total is no more than 1 you should bet the minimum of one unit, but if it is 2 or more you should bet the same number of units as the point-count total.

THROWN OUT

In many casinos the dealers and officials are trained to spot card counters, and if you play this strategy for some time you may find that you are invited to leave. In Thorp's case the casinos tried to distract him with drinks and pretty girls. So you should try to find a table where there are a few empty seats, then stand and watch the game from the start of a deck and when the point count rises to + 4 or + 5 you should sit down to play. That way, if you are asked to leave after playing for a short while, you are more likely to be going home a winner. Remember that once the dealer reaches the end of the deck and shuffles the cards, you must start the point count again at zero.

MIKE GORNELL

Thorp's book offers many tables which provide the information needed to make the correct decisions when drawing, splitting pairs, etc. Once you have used your program as a trainer to master the basic strategy, you should buy a copy of the book and learn the more advanced techniques and the tables that make them possible. The information in this article merely scratches the surface of the concepts which Thorp has developed, and any reader who finds blackjack interesting should study the book very thoroughly.

When holding anything up to and including 17, count an ace as 1 in the following situations. If you have a pip count of 12, stand only if the dealer shows a 4, 5 or 6. If your count is 13, stand only if the dealer shows a 2 or 3. With 14, 15 or 16 you should almost never stand, the only exceptions are when holding two 7s when the dealer shows 10, and holding three or more cards adding up to 16 when the dealer shows 10.

When holding 17 stand only when the dealer shows 7 or higher. With an ace in your hand, for which count 11, and holding 18, you should stand unless the dealer shows a 9 or 10. With an ace — again counting 11 — and a total of 19, stand only if the dealer shows a 9 or 10. In all other circumstances you should draw a card.

Always split aces or 8s. Never split 10s — including face cards — or 5s. Split 9s unless the dealer shows a 7, 10 or ace; split 7s unless the dealer shows 9, 10 or ace; split 6s unless the dealer shows 8, 9, 10 or ace; split 4s only if the dealer shows a 5; and split 3s or 2s unless the dealer shows an 8, 9, 10 or ace.

There are two situations to consider when doubling down, depending on whether the player has a soft total where an ace counts

(continued on next page)

◄ ● Circle No. 164

(continued from previous page)

as 1, or a hard total where an ace counts as 11.

Counting the ace as 1, the player should double if and only if: he holds cards from ace to 7 and the dealer shows 3,4,5 or 6; he holds cards from ace to 6 and the dealer shows 2,3,4,5 or 6; he holds an ace with a 5,4,3 or 2 and the dealer shows a 4,5 or 6; or he holds two aces, which he cannot split because his first three cards were aces and he has already split a pair, and the dealer shows a 5 or 6.

If the player does not have an ace or is counting his ace as 11, he should double if and only if: his total is 11; his total is 10 and the dealer shows a 10 or ace; his total is 9 and the dealer shows 7,8,9,10 or ace; or his total is 8 but not made up of a 6 and a 2, and the dealer shows a 5 or 6.

OPPONENT

First you should write a program that plays blackjack against you. Try to cater for more than one player competing with the house, so that your friends can join you or you can play more than one hand against the house simultaneously. You can have fun designing playing cards and providing routines which simulate the shuffling and dealing in a visually interesting manner. You can then use this program just for fun, playing against it and getting used to the rules of the game.

You need a routine to test your ability to keep track of the point count. This routine can serve as an option so when it is toggled on it will advise you whenever you make an incorrect bet. You can display a message saying for example, "Wrong bet! The count is now −3." Try to get a lot of practice keeping count of the high and low cards, until you reach a level of proficiency that almost guarantess that you will not make a mistake.

Having trained yourself to keep track of the high and low cards as they appear, you will be able to bet the correct amount of money on each hand. Next you should learn when to draw and when to stand, and your program should provide similar warning messages whenever you have made the wrong decision, such as "Wrong: You should not stand on 13 when the dealer is showing 6." Do not allow yourself the luxury of taking back your wrong decisions and correcting them. By having the program keep score of how much money you have won or lost in a playing session, you will be better able to monitor your progress and you will know when you are ready to bankrupt the Las Vegas casinos.

When you are confident that you have remembered all aspects of the strategy for drawing and standing you are ready to learn the splitting strategy and then the doubling-down strategy. In each case the program should give you warning messages whenever you make a mistake. You will need a lot of practice to become really skilled at playing Thorp's system, and those who have a good memory will find it easier.

INCREASING SPEED

Provide your program with different speeds of operation and start learning at the slowest speed. The program should sound a warning beep when you have taken more than, say, 10 seconds over a decision, and it should keep track of how often this happens. Once you have progressed to the stage where you no longer make mistakes in the strategy, you will be ready to play a faster game.

You need to play quickly because casino dealers deliberately deal as quickly as possible, and try to hurry the game along. This is partly to make it more difficult for card counters to keep track of what is happening, and partly because the more hands that are played the more money the house will make.

When you can play very quickly against your program, and regularly take it to the cleaners, you may decide to venture into a casino to try your luck. If you do, remember that the system is mathematically sound, but you may need to play for a long time before it bears fruit. To play for a long time can require a fairly large bankroll, so do not start with, say, 10 times the minimum stake and be convinced that you will win. Equally, you should never under any circumstances go into a casino with more money than you can afford to lose.

Edward Thorp is not the only person to have worked out a winning system at blackjack. Since the first edition of his book was published in 1962, many other mathematicians and computer scientists have elaborated systems that work in a similar way.

Finally, may I make it clear that I do not wish to encourage anyone to gamble against their better judgement. I can in no way be held responsible for any amount of money that you might lose, even if you read and memorise every page of Thorp's book. On the other hand, if you win a lot of money, please send my 10 percent commission direct to my account at the National Westminster Bank.

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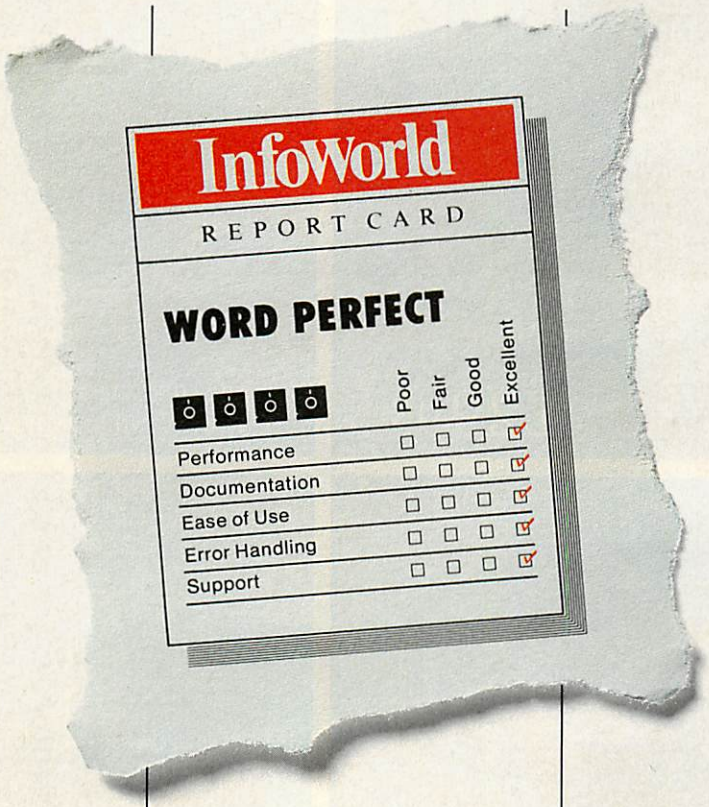

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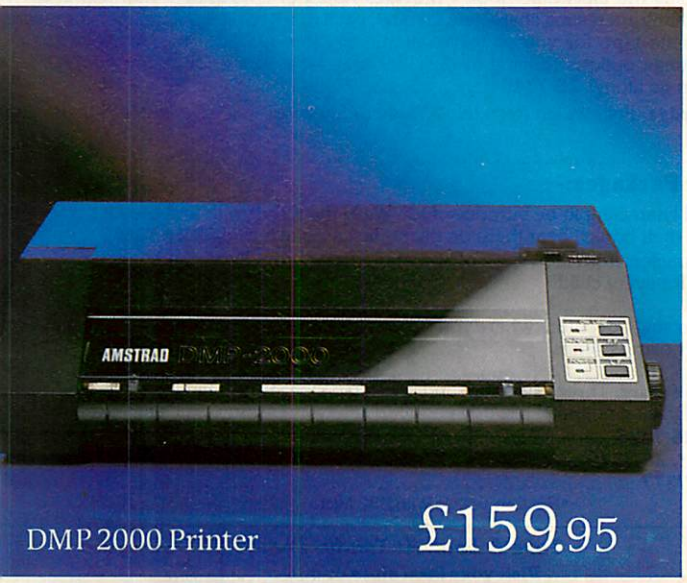

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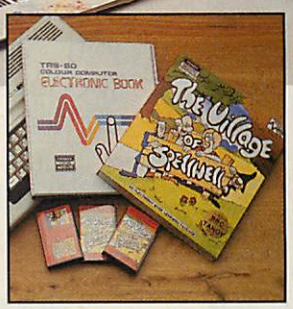

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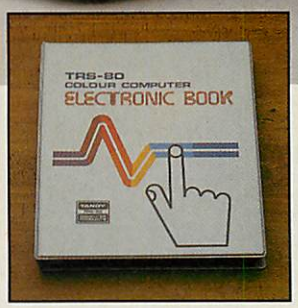

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BY BEN KNOX

PLINK

Peoplelink is a U.S. public information system to rival Compuserve.

Peoplelink, or Plink as it is usually called, is an American public information system which was opened last year in direct competition to Compuserve.

There is no comparison between the two systems: Plink has far fewer facilities and its user base is minute. Even with these disadvantages, though, Plink can be attractive to British users, not least because its on-line charges are as little as half those of Compuserve. Additionally, Plink does not worry about people joining the system from the U.K. and even offers lower rates at some times of the day, because U.K. users have to pay their own communications charges through PSS.

Figure 1 is the main menu of Plink. Partyline is the chatting facility of Plink. Here you can converse with other users by typing messages in at your keyboard. The system works in a very similar way to Compuserve's CB Simulator. The following commands are available on Partyline:

/TOP — display menu
/SUM — see active lines
/LIS — list Partyline users
/LIS 6 — list users on line 6
/QUIT — go to main menu
/LIN 24 — enter line 24
/NAME BOB — change name to Bob
/HUSH JOE — you can't hear Joe
/HUSH — cancels Hush
/FIN MARY — find user Mary
/WHERE — where am I?
/CHAT SUE — talk private to Sue
/MSG — sends a private message
/GAG — you can't get messages
/CHAT — talk with anyone
/MUFF TOM — Tom can't see you
/MUF — cancels muffle

As with Compuserve CB, all users have a handle by which they can be recognised. You can either talk to a group of users on a particular channel, or have a private conversation with one other user.

Mail is Plink's electronic mail facility. As with most other Email systems, you can send a message to one or more users, reply to or forward received messages, and store old messages.

In User Directory you can look up users who have similar interests to your own, or live in your area. Directory entries are displayed in the format shown in figure 2. On the system, users are recognised by their handles instead of their real name, or a number.

In the bulletin board area, users may leave messages on particular subjects. The bulletin boards work in much the same way as the Special Interest Groups (SIGs) which are found on micro-based bulletin boards. There are nine subjects covered, as shown in figure 3.

Password enables you to change your password. Information provides information on rates, access, special offers and so on. Default sets the system output format for your terminal. Find a User carries out a directory search. Billing gives on-line billing information, and On-line Herald is the electronic house magazine, which looks like figure 4.

Plink costs $29.95 to join. Thereafter, it costs $1.67 per hour for the first three hours used for each month and then is $2.95 per hour for 300/300 baud or $5.95 for 1,200/75 baud. These charges run 24 hours a day for overseas users. Access is via PSS Network User Address A9311031200070.

Further information can be obtained from: American Peoplelink, 3215 N Frontage Rd, Arlington Heights, Il 60004 U.S.A.. Telephone: (U.S. area code 213) 870-5200. If you join, send me an Email. My ID is UK Ben. PC

FIGURE 1. MENU

```
PEOPLE/LINK Main Menu

 1  PARTYLINE                  /PAR
 2  Mail                       /MAI
 3  User Directory             /UD
 4  Bulletin Boards            /BB
 5  Password                   /PAS
 6  Information                -
 7  Default (Settings)         /DEF
 8  Find a user                /FIN
 9  Billing                    /BIL
10  Online Herald - JULY ISSUE

Enter number, command or /HELP
M>
```

FIGURE 2. DIRECTORY

```
ID: KNIGHT
-------------------------------
NAME: J.DOE
CITY: MOUNTAIN VIEW
STATE: CA
ZIP: 94043
COMPUTER:    RADIO SHACK COLOR
INTERESTS:   MUSIC/SKY DIVING/ART
```

FIGURE 4. HERALD

```
THE ONLINE HERALD

July 1985

1 - FEATURE STORIES
2 - LETTERS-TO-THE-EDITOR
3 - EDITORIAL
4 - BIASED MOVIE REVIEWS
5 - ASK JENNY
6 - PARTYLINE CHATTER
7 - BRAINTEASERS AND STUFF

Please enter your choice:
->
```

FIGURE 5. HERALD COMMENT

```
EDITORIAL
---------

        THE SPECTRE OF TERRORISM

   Somewhere around 15 years ago, the media created the word
"skyjacking". These prototypical skyjackers weren't all such a bad
lot. Not interested in dying, these non-political types were satisfied
to demand a million bucks or so, and then go on their merry way.  As
their success rate dwindled and airport security became a reality, air
piracy in the U.S. faded away.

 [...and so on]
```

FIGURE 6. HERALD AGONY AUNT

```
ASK JENNY
---------
Dear Jenny,

OWW WOW...I am a new user.  What an
awful experience as I was reading all those DEAR JENNY letters and I
couldn't figure out how to stop.  I typed /HELP and learned that all
kinds of slash commands would help me get away from those torrid
letters, but I just kept getting them again.  The only thing that
actually worked was /TOP.  How do you like that?  Should I ask for my
money back??  Or should I have read all the letters and answers?  Bye
for now.
                HONOLULU
                ********
Dear Honolulu,

If you ever have trouble or think you're stuck in a program, you
should try typing a <CONTROL C>.  Glad you were able to find your way
out, otherwise, I might have had to come over to Honolulu
and personally help you.
                Jenny
```

FIGURE 3. SPECIAL INTEREST GROUPS

```
Name:  COMPUTERS
Count: 9
Descp: SHARE INFORMATION ABOUT COMPUTER HARDWARE, SOFTWARE AND
PERIPHERALS
key:   DISKS, DISKETTES, PRINTERS, PLOTTERS, MODEMS, TERMINALS,
PACKAGES

Name:  HOBBIES
Count: 3
Descp: SHARE INFORMATION ABOUT YOUR FAVORITE HOBBY
key:   SPACE, FREE, TIME, STAMPS, COINS, TRAINS, MODELS, COLLECTING,
ANTIQUES

Name:  MISC
Count: 12
Descp: OTHER CATEGORIES
key:   GENERAL/OTHER/SPECIAL/DIFFERENT/MISCELLANEOUS

Name:  PARTYLINE
Count: 50
Descp: LEAVE PUBLIC MESSAGES FOR YOUR FRIENDS ON PARTYLINE HERE
key:   CB, TALK, PEOPLE, CHAT, PARTI

Name:  PERSONAL
Count: 12
Descp: PERSONAL/PEOPLE/MEET/MEN/WOMEN/TEENS/MATCH/ROOMATES/
key:   PERSONAL/PEOPLE/MEET/MEN/WOMEN/TEENS/MATCH/ROOMATES

Name:  PLTECH
Count: 7
Descp: ANSWERS TO THE MOST FREQUENTLY ASKED TECHNICAL QUESTIONS ABOUT
PEOPLELINK
key:   SOFTWARE/TELENET/TYMNET/MAIL/PARTYLINE/UD/TANDEM/BB/TOPPER

Name:  SELL
Count: 12
Descp: ITEMS FOR SALE
key:   CLASSIFIED/SELL/SALE/FOR SALE/

Name:  TEENS
Count: 35
Descp: TEENAGERS
key:   TEENS/TEENAGERS/

Name:  TRIVIA
Count: 19
Descp: TRIVIAL PURSUIT GAMES ON PARTYLINE
key:   TRIVIAL/PERSUIT/GAMES/RULES/INFORMATION/CODES/
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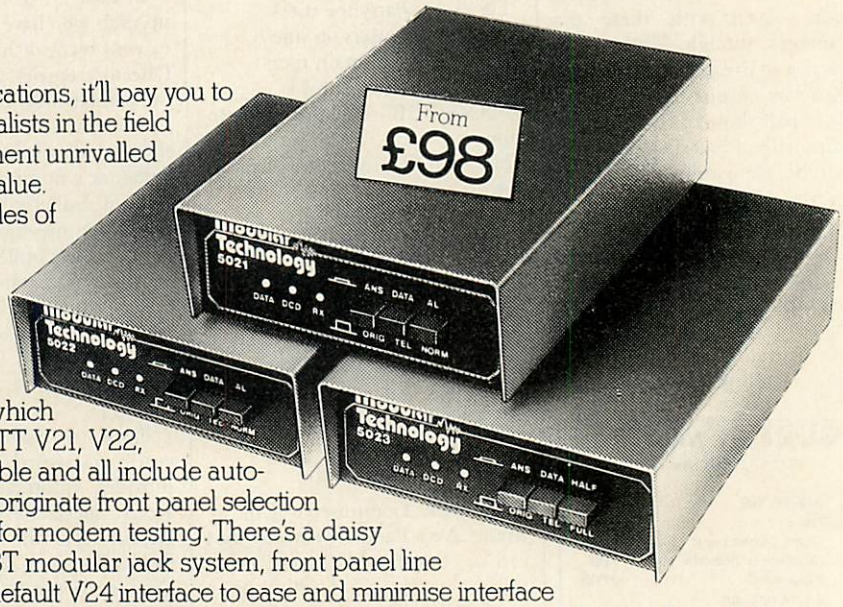

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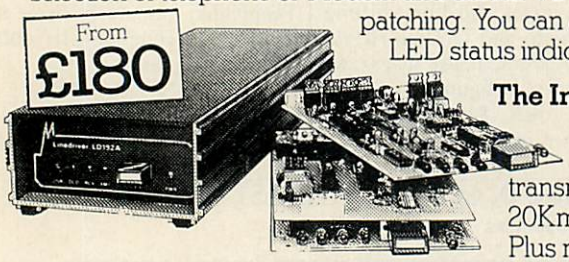

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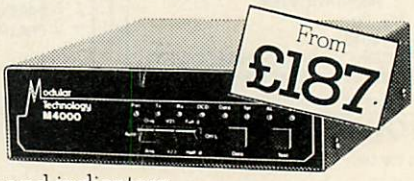
M4000 Series Multi-Mode Modems Another recent addition, this series of transmit and receive Modems are both BABT approved and conform to CCITT requirements. They are microprocessor driven, switchable between V21/V23 and are capable of working to Bell standards, answer or originate.



The number of features is astounding and includes auto-answer, self-diagnostics and a host of front-panel switches and indicators.

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Q I use a word processor, and am considering a spelling-checking program to work with WordStar. Can you explain how they work, and list some of the programs available, with some comments on their good and bad points.

M STOKES

A There are quite a few spelling-checking programs. A review in the January 1984 edition of *Practical Computing* describes Microspell, Spellguard, Sensible Speller and Magic Spell. Other spelling programs work directly with WordStar.

Spellstar is one of the original spelling checkers. It was written by Micropro, the originator of WordStar, so not surprisingly it can be run quite easily from the WordStar No File menu. It compares each of the words in your text file with those in its own main dictionary and flags the words that cannot match. The main dictionary, which is stored on disc, contains some 20,000 English words.

The problem common to all spelling checkers is that unless the dictionary is very big, a large number of correct words will not be matched and will consequently be flagged as errors. If the dictionary is large this problem is avoided, but the program runs very slowly. Many correct words are flagged, such as the names of people or firms, scientific, medical, technical or legal words. You can create one or more supplementary dictionaries for yourself that hold these special words. After checking, you examine the flagged words in turn, and may correct the word, add it to either the main or the supplementary dictionary, or bypass the word.

Spellstar works, but it is not too friendly to beginners, is rather slow, and flags a lot of correct words unless you develop your own dictionary. A full 11-page description is given in *WordStar and CP/M made easy,* published by John Wiley. Spellstar is available quite cheaply bundled with WordStar and Mailmerge. It runs on CP/M-80, MS-DOS and PC-DOS systems.

Correctstar is the new offering from Micropro, and is much faster, more friendly and much more versatile. The dictionary holds 65,000 words, and works phonetically. When it finds a word not present in the dictionary it suggests possible alternatives and offers you the choice of replacing the word with a suggested word just the once or making the change every time it occurs throughout the whole file. Alternatively, you may add the word to the dictionary or ignore it. If changing the word spoils the layout, the paragraph is reformatted automatically. It is a great improvement, but is only available for PC-DOS and MS-DOS machines with at least 128K of memory.

Corrector is another spelling checker. It not only proof reads your text file, but uses its dictionaries — up to nine of them — to suggest possible correct spellings of words it does not recognise. It was written by Supersoft and requires at least a 48K CP/M-80 system.

The Word Plus is rated highly in the U.S. and is much more than just a spelling program. It is easy to use since it displays suspect words in context. It works quickly and it is not too expensive. It proof reads at about 5,000 words a minute, using a 45,000-word dictionary. It looks up correct spellings, and can also insert soft hyphens in words throughout a file, so that words break sensibly and lines are reasonably full. It costs $150 from Oasis Systems, 2765 Reynard Way, San Diego, Ca 92103, U.S.A.; an earlier and cheaper version called The Word costs only $75.

A new one from the States that looks promising, and which we would like to try is V-Spell, sold by Compuview Products Inc., 1955 Pauline Boulevard, PO Box 1349, Ann Arbor, Mi 48103, U.S.A. It is menu-driven, has a 60,000-word dictionary, proof reads at speeds better than 1K per second equivalent to two seconds per page, and offers up to 40 alternative spellings for each word.

The Perfect Speller has a 50,000-word dictionary, identifies and corrects spelling errors and works in conjunction with the Perfect Writer word processor. This software is provided free with the Advance 86 computer and works at a speed of 4,000 words a minute, which is less than 10 seconds a page.

One final but vital point: make sure that the dictionary you are provided with on disc contains English spellings, not American.

OUTGROWING THE BBC MICRO

Q I use a BBC Micro model B, with a Datagem ROM to give the database program and two 400K Cumana disc drives. I have problems with a large database containing information and cataloguing thousands of photographs. When I started my filing system for negatives I used eight different fields. What a waste of effort this turned out to be; with hindsight I should have had just three and thereby saved an enormous amount of time when adding new records.

Because of the limited memory of the BBC, the disc has to be searched. This can take an annoying amount of time. Is there any way round my problem?

VICTOR BLACKMAN

A Several points are relevant to your problem, which is essentially that your database runs very slowly. First, the BBC only has 32K memory available. Thus, when searching through the database, you will get very frequent disc accesses to allow the next section of the information in the database to be read into memory. Searching through memory is quick, but disc accesses are always slow.

If more memory was available to buffer the data then you would need fewer disc accesses, hence the overall process would be quicker. A standard method of increasing the memory available — and speed — is to fit a 6502 second processor, which simply plugs in as an extra box. The second processor has an extra 64K of memory, though because some of it is used for other purposes you do not get the full 64K for your program. Also, you need a specially tailored version of your program which sits higher in memory, and this may not be available. I would enquire from a dealer, since this combination may solve your problem, and it would have the attraction that you could still use all your existing equipment, and still use the same discs with your database.

From what you describe, you have a lot of entries in the filing system for each negative. If you can reduce either the number of fields used, and/or the length of each field then the amount of information which must be read from disc will be reduced, and the search time will be improved accordingly. One way of doing this is to use Datagem to transfer data into a new database with fewer fields. Alternatively, if the data is stored as ASCII characters on disc, it should not be too difficult to write a program in Basic which reads all eight fields that you have stored on one disc, discards some unwanted fields, and writes a new simplified database on a new disc in the other disc drive. The new shortened disc should run faster.

The most reliable — and most expensive — solution is to buy a bigger computer.

Q I have WordStar version 3.3. Unlike previous versions it does not allow you to customise features other than those specified in the menu of the customisation program. Is there a way short of invoking DDT and guessing my way forward? I particularly want to change the default values for some of the questions asked when printing a document. Specifically, I want to change the default for the question "Pause for paper change" to Yes

DAVID C MINUGH

A We do not recommend that you alter the program with DDT. Get to the Patcher routine which is part of the Install.Com or WInstall.Com program, and you can then modify bytes in the user area of the program. To enter the Patcher when using WordStar version 3.0 or below, you simply reply No to the question "are the modifications to WordStar now complete". This feature appears to be missing from WordStar versions 3.2, 3.3 and later, but there is an undocumented feature, which we described in the March 1985 edition of *Practical Computing*. Instead of typing a letter to select one of the menus, or X to exit from Install, type a + to get the Patcher. You will be asked:

LOCATION TO BE CHANGED
(0=END)

You say you want to alter some of the defaults for questions asked when you use the WordStar P option to print a file. Presumably this is because you would like to be able to press Escape to take all of the default answers, rather than having to answer all the questions one by one.

(continued on next page)

(continued from previous page)

The default print options are stored at location Podblk. The addresses may be different on your version of WordStar, and will certainly be different on 16-bit versions. This does not matter at all, since you are finding the location using the mnemonic names rather than the actual addresses.

On WordStar versions 3.2 and later, type the colon before the mnemonic name Podblk, but on earlier versions of WordStar type the colon after the name.

```
LOCATION TO BE CHANGED
  (0=END) :PODBLK
ADDRESS : 03CAH OLD VALUE:
  00H NEW VALUE:
```

This concerns the question about outputting the document to a disc file rather than to the printer. You may, of course, type either Y or N in reply to the question, but the value stored here defines the default: 00hex indicates No, while 0FFhex indicates Yes. You may either type a new value, or press Return to leave this byte unchanged and go on to the next byte.

```
LOCATION TO BE CHANGED
  (0=END) :PODBLK+1
ADDRESS : 03CBH OLD VALUE:
  00H NEW VALUE:
```

This holds the default value for the question about form feeds. You may, of course, answer the question Y or N. The value 00hex indicates no form feeds, so starting a new page is achieved by using a lot of linefeeds. The value 0FFhex indicates Yes, use form feeds. As before, you may either type a new value, or press Return to go on to the next byte.

```
LOCATION TO BE CHANGED
  (0=END) :PODBLK+2
ADDRESS : 03CCH OLD VALUE:
  00H NEW VALUE:
```

This sets the default value for page formatting. As before, you may answer the question with Y or N, or press Return to get the default. The value 00hex indicates No page formatting, while 0FFhex indicates Yes, format the pages.

```
LOCATION TO BE CHANGED
  (0=END) :PODBLK+3
ADDRESS : 03CDH OLD VALUE:
  00H NEW VALUE:
```

This sets the default value pausing between pages. As before, you may answer the question with Y or N, or press Return to get the default. The value 00hex indicates No pause between pages, while 0FFhex indicates Yes, have a pause to let you insert a new sheet of paper.

If you use a printer capable of microspacing, another worthwhile change is to alter WordStar's microjustify algorithm so that it puts more emphasis on adding microspaces to the gaps between words, rather than inserting microspaces between the letters in a word. This can be achieved by using the patcher subroutine to change the hexadecimal value at location DMJWB from 00hex to FFhex.

Q **I have an Apple with DOS 3.3 which is used for accounts, and a Dragon, also with discs. I am not sure about the biology of dragons — aren't they cold-blooded reptiles? — but the metabolic threshold of mine is 50°F. As our computer room is an external portable unit, the early morning temperature can be well below freezing, and this causes problems. Also, if I use a floppy-disc cleaning kit, does it make any difference which command is used?**

M J HOSKEN

A You will find that the rated operating temperature for floppy discs is 50°F to 125°F. In winter an unheated hut will fall far below the minimum temperature for floppies, and this is the cause of your problem. A fan heater with a time switch to come on an hour before you use the machine would warm the room and should solve the problem.

When using a cleaning disc to remove oxide and dirt from the read/write head of the disc drive, you must make the head engage and spin the disc for half a minute or so. You may do this by attempting to boot the system two or three times on the cleaning disc, or alternatively you may boot the system properly with a genuine floppy, then replace it by the cleaning disc and type Dir, Catalog, *Cat or whatever the command is to list the files in the directory. It does not take long to clean the head: the disc is spinning at 300rpm, so in 30 seconds it has rotated 150 times.

Q **Is it possible to write a program — say, in machine code — so that individual words can be represented as single bytes, for the purpose of condensing an entire glossary or dictionary on to one disc or tape. I understand that the ASCII set comprises just a small number of the bit combinations constituting individual bytes.**

I estimate that in this way a glossary could be reduced in volume to about one-quarter, which makes a dictionary on a disc a feasible idea. Perhaps there is software already available to do this job?

R LATHAN

A You are quite right in suggesting that the ASCII character set comprises just a small number of the possible bit patterns. Since a byte comprises eight bits, there are 2^8 or 256 different bytes. In the ASCII character set there are 96 printable characters and 32 control codes — Return, Linefeed, etc. If you are storing text, ASCII is thus not the most dense and efficient method.

There are 26 capital letters, 26 lower-case letters, and possibly you may need the 10 numbers, and up to 30 other characters such as punctuation marks, brackets and a space. Eight bits can provide 256 different arrangements, so there is a great deal of redundancy. Even if with only seven bits in use, there are still 128 arrangements, and still some redundancy.

By storing the data in seven bits instead of eight, a saving of 12.5 percent can be achieved. If the number of different characters stored can be limited to 64 — which is easy if you can exclude the numbers — then these can be stored in six bits, giving a space saving of 25 percent. Another space-saving technique is to store commonly occurring words as a single byte, using one of the bit patterns not used for the letters and numbers.

There are several well-known and established techniques for text compression that can save 50 to 60 percent of the space normally required. There are essentially two different cases: the first where you are trying to save space by compressing natural English text into a smaller space, and the second a more specific case where you have an alphabetical list such as a dictionary, a glossary or a list like a telephone directory.

The first method, which is useful for normal text, combines the techniques of using less than eight bits to store each character, and storing common words in tokenised form as a single character. This technique works well for normal text, but may substantially increase the size of a list of names and addresses, or a database or spreadsheet. A useful article about this was written by Mike Lewis in the June 1984 edition of *Practical Computing*. A commercial program called Clip is available to do this from Keele Codes Ltd, University of Keele, Keele, Staffordshire for £95.

The second method is sometimes called a dictionary compression scheme; it is only applicable to alphabetical lists and works in a different way. Since the words are in alphabetical order, neighbouring words probably have the first few letters in common. Instead of storing all the letters in the word, you can save space by storing the number of letters at the beginning of the word that are the same as in the previous word in one byte, and then each of the letters that are different at the end of the word in one byte each. With care, each character can be coded in six bits rather than eight.

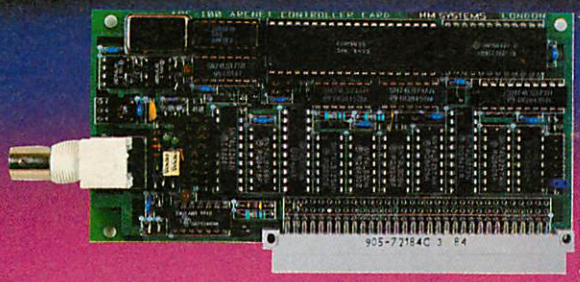
These techniques are extensively used in the dictionaries for the better commercial spelling-checkers. For example, Spellstar stores over 20,000 words in a 98K disc file. These methods are explained in some detail by Mike Lewis in the April 1985 edition of *Practical Computing*. Another text-compression algorithm is given in an article in the January 1982 edition of *Byte*.

A totally different approach is to redefine the coding system used to store characters. ASCII always uses eight bits to store each character. Denser coding systems can be produced whereby different characters have bit codes of different lengths. Since letters like e and t occur far more frequently than z or k, e and t would be given a short code — say three or four bits — whereas z or k would get long 10-bit or even 12-bit codes. The theory for developing optimal codes of this type can be found and studied in standard textbooks on coding theory. PC

In "Ask PC" John and Timothy Lee answer questions on any area of microcomputing. If you have a nagging problem, write to us, writing ASK PC clearly on the top left-hand corner of the envelope. The most representative questions of general interest will be answered and published each month.

To be considered, letters should contain one question only, and must include your name and address, together with a stamped addressed envelope. Because *Practical Computing* receives hundreds of letters each month, we cannot guarantee that personal replies will be given, but we will do our best.

Networking NOW – IBM/PC and Apricot



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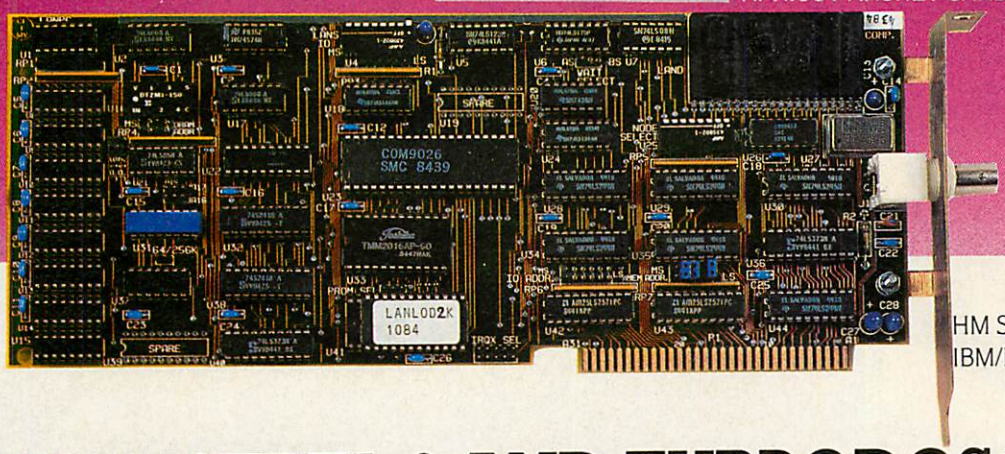

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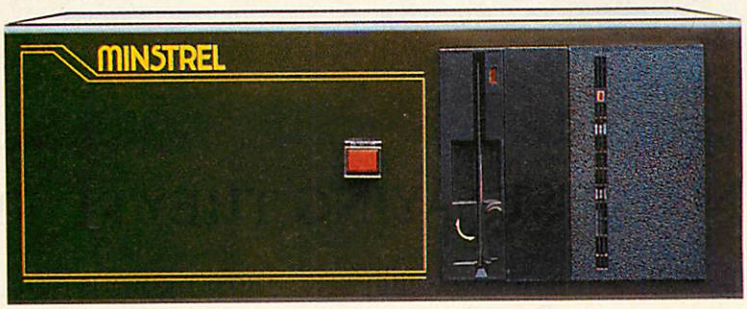
A twelve user Apricot file server with 64MByte Winchester disk will cost around £11,775.00. Extra users cost £410.00 each.



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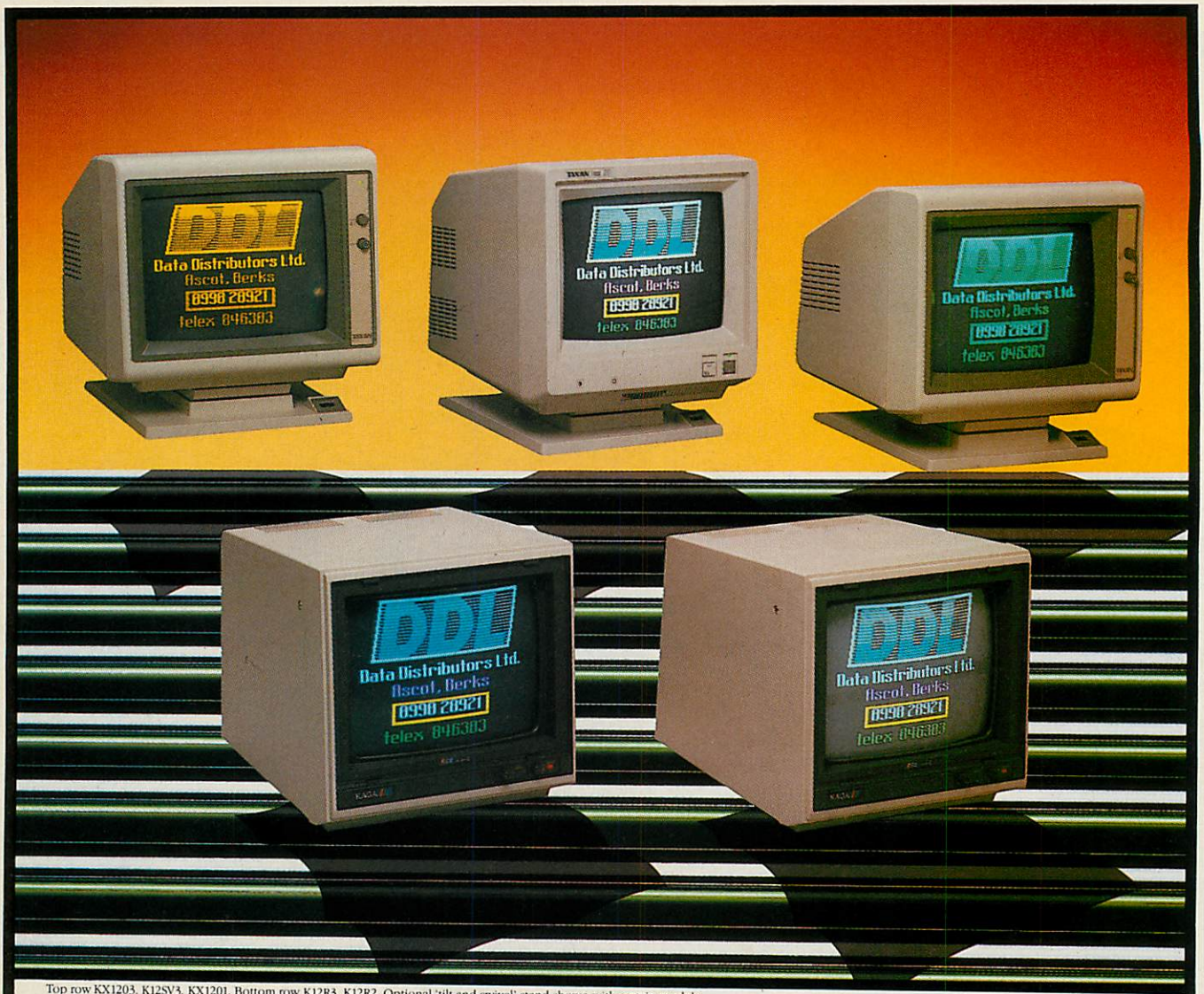

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TIME FOR C

The C programming language has been largely ignored by book publishers, but at last there is a reasonable choice of titles. Mike Lewis picks out six of them.

BOOK REVIEWS

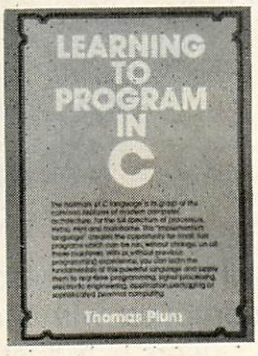
C HAS been lurking at the back of the programming community's collective consciousness for some years now. Still only comparatively few programmers use it, but many of those who do are completely devoted to it. A few more have dabbled with it but found it too esoteric or obscure. For the majority, it is always the language they would most like to know more about, the one that they might get round to learning next.

Until recently, the would-be student of C was handicapped by a lack of books on the language. But now there is a reasonable choice of C titles, although the quality is highly variable.

One of the best of the new offerings is Bruce Hunter's *Understanding C*. Its author has hit the mark by aiming the book squarely at the experienced programmer. This is good, not only because bookshops are already full of texts which explain binary arithmetic, but because C, while not especially difficult, will be mastered more quickly by someone who has already cut his or her teeth on Basic, Pascal or Logo.

The book plunges you straight into the language — no messing around with whole chapters on "Hello World" programs — and you should be able to write useful C code after the first two dozen pages. The entire language is covered and the only topic that I could not find was the Enum data type. There is also a useful overview of C's relationship with Unix. Such an overview is no longer as relevant as it once was, but it should help many people to understand the terminology and conventions found in C manuals.

There is also an excellent chapter on current C compilers, with comments on 15 leading products, plus some benchmarking. I was pleased to see that my own two favourites, de Smet and BDS, met Hunter's approval. However, the main part of the text is completely independent of any implementation or operating system, and equally useful for those working with CP/M, MS-DOS, Unix, and anything else. Highly recommended.



Also recommended is *Learning to Program in C*, by Thomas Plum. This gives detailed coverage of most of the language, with especially good treatment of functions and recursion. There is a slight bias towards Unix, but not enough to be a problem. The book includes a handy reference section and plenty of examples and exercises, all of which are beautifully clear.

Curiously, the book starts with a rather silly chapter which tries to explain memory by analogy with pigeon holes in a hotel reception. This is both ineffective and superfluous, especially given that the rest of the book is so clearly intended for experienced programmers. But apart from the opening nonsense, Plum's book is worth having.

This is more than I can say for the inaptly named *Big Red Book of C*. True, the cover is red, and the book is about C, or at least a small subset of it. But big it isn't. At 166 pages, it is not only the smallest of the books under review, but also the most lightweight.

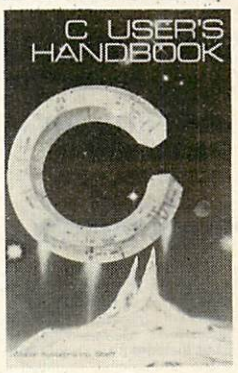
In fact, Kevin Sullivan barely touches on the topics that give C its special flavour, like structures and pointers. His example programs have a good sprinkling of mistakes — his blind spots seem to be missing braces and undeclared variables — and even the index contains errors. There are no exercises; there are cross references to non-existent appendices; and the English is, to say the least, eccentric — "assignation" instead of "assignment" being one amusing example.

Most of the sample programs are given twice: once for a compiler which Sullivan calls LC — Lattice C? Living C? — and again for "the CP/M compiler" — he does not say which. The main differences between the two seem to be in environment-dependent aspects, like the value of end-of-file flags. This confuses rather than clarifies, especially as the differences are generally handled by #Define commands, which are provided specifically to overcome problems of this kind.

Programming in C for the Microcomputer User is another lightweight. Robert Traister deals only with the most elementary C concepts. He gets only as far as character strings, then bows out with some skimpy sample programs, ending with a section on his favourite compiler — Supersoft C. There is nothing in this last part that you cannot find in the Supersoft manual, and the author fails to point out which features are specific to this implementation and which are standard.

The worst thing about this book is the fact that every feature of C is explained in terms of Basic. The approach is always the same: Traister presents a new concept, explains it by giving an example of Basic code, then translates this into C. This bizarre system falls down because C's strengths are precisely those features that are most unBasic. It might not be so bad if the book's intended audience was clear from the title. As it is, all non-Basic programmers who have bought a copy should be entitled to their money back.

Another book by Robert Traister arrived as we were going to press. In it, the author continues his preoccupation with Basic, but at least this is clear from the title: *Going from Basic to C*. Apart from a useful chapter on file handling, the ground covered is much the same as his earlier volume, reviewed here, and the treatment is just as skimpy.



Finally, *C User's Handbook* is the biggest of the books under review, the most detailed, and probably the most complete. It is not, however, the most readable. The authors claim that it is a "primer and tutorial", but I cannot see anyone actually learning the language from this volume. You would have to fight your way through 175 pages of dense prose on operators and data types before you could start writing code for your first C program. However, as a reference source, the book is definitely worth having. PC

TIME FOR C

Understanding C by Bruce H Hunter. Published by Sybex, £16.95. ISBN 0 89588 123 3.

Learning to Program in C by Thomas Plum. Published by Prentice-Hall, £12.95. ISBN 0 13 527847 3

The Big Red Book of C by Kevin Sullivan. Published by Sigma Press, £7.50. ISBN 0 905104 68 4

Programming in C for the Microcomputer User by Robert J Traister. Published by Prentice-Hall, £17.05. ISBN 0 13 729641 X

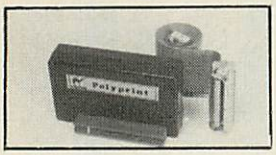
Going from Basic to C by Robert J. Traister. Published by Prentice-Hall, £19.20. ISBN 0 13 3577996

C User's Handbook by Weber Systems Inc. Staff. Published by Addison-Wesley, £12.95. ISBN 0 201 18082 0

CAMEL PRODUCTS

ZX81 COMMODORE C-64 BBC COMMODORE C-64 BBC COMMODORE C-64 QL SPECTRUM ZX81 COMMODORE C-64 BBC

NEW POLYPRINT for Spectrum



. . . The interface which likes to say . . . Ja and Oui and Si and of course YES! A Spectrum Centronics interface with multilingual chars in EPROM, as in EPSON FX80 printer. Printer driver also in EPROM. User notes show how to use EPROM for UTILS or down loadable chars.

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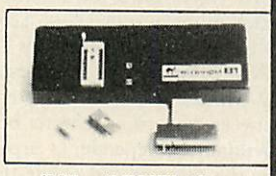

for the 2716/32/32A/64/64A/128/128A. CHECK, READ, PROGRAM & VERIFY all or part of EPROM.
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```
STATUS      NO. OF SYSTEM —HEX
            EPROM TYPE —27128
            RAM START ADDR —4000
            EPROM ST. ADDR — 0000
            JOB LENGTH — 4000
            TASK — CHECK
WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO
   RAM
Y) BLOW AN EPROM WITH DATA FROM
   RAM
Z) VERIFY THAT EPROM DATA IS THE SAME
   AS IN RAM
Q TO QUIT ..................R TO RESTART
FAST CODES AVAILABLE
D     H     POR     WXYZ
```

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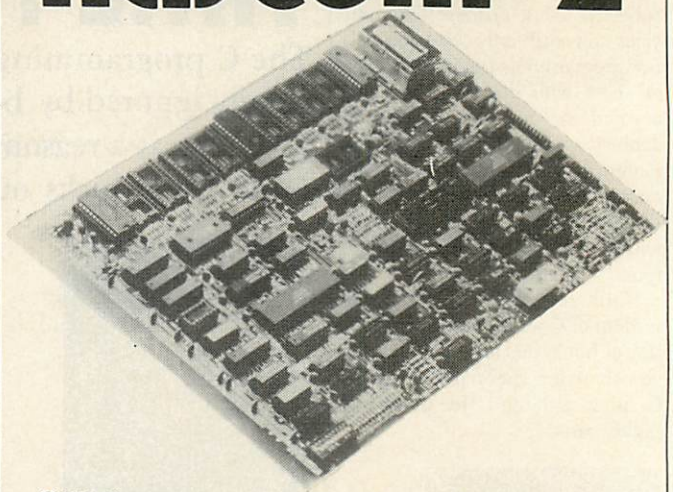
nascom-2



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Tandata micropacks include VIEW-TEX, the most powerful viewdata package, and TAN-LINK, which combines viewdata and 80 column, for the IBM PC, ACT Apricot and ICL Personal Computer etc., as well as packages for the Apple II and Macintosh, BBC, Commodore, etc. – all explained in our special Communications Software Catalogue.

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LANGUAGES

Microsoft	CP/M	MSDOS	Digital Research	CP/M	CP/M-86	PCDOS
Basic Interpreter	£340	£340	CBASIC Interpreter	£130	£295	
Basic Compiler	£385	385	CBASIC Compiler	£445	£535	£345
FORTRAN Compiler	£485	£340	PASCAL MT +	£295	£345	£345
COBOL Compiler	£680	£680	C Compiler		£295	£295
C Compiler		£485	PERSONAL BASIC Int		£135	
PASCAL		£295	CIS COBOL	£425	£425	
BUSINESS BASIC Compiler		£450	FORMS-2	£110	£110	
			FILESHARE	£250	£425	
MACRO ASSEMBLER	£195	£150	FORTRAN-77		£295	£295
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ASCOM: The most flexible asynchronous communications package available to the micro worls. Interactive, batch, menu-driven. Available for CP/M, CP/M-86, MS/PCDOS.....£170
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ASSEMBLER PLUS: Disassembler for 8080 and Z80 programs.....£185
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RCS PAYROLL: Full function, highly used package.....£500
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ATARI ST 520ST

POWER WITHOUT THE PRICE

THE NEW ATARI 520ST

Under the new leadership of Jack Tramiel (former boss and founder of Commodore Business Machines), Atari Corporation have marked their entry into the world of business/personal computers with a machine which leaves the competition standing. Tramiel's slogan 'Power Without the Price' has been implemented in the manufacture of the new 512K Atari 520ST colour computer which offers the user amazingly high performance at an incredibly low price. Launched as a work-station, this new system incorporates seven software packages as well as the 520ST computer with 512K RAM, mouse controller, high resolution monochrome monitor (640x400), 95 key keyboard (with 18 key numeric keypad), MIDI interface, GEM and a 500K 3½ inch disk drive, all for the package price of only £651.30 (+VAT = £749). Dubbed the 'Mac beater' and the 'Jackintosh' (after Atari's Chief, Jack Tramiel), Atari's new machine has been directly compared with the Apple Macintosh RRP £2595 (+VAT = £2985) which offers similar features and capabilities but at a much higher price. Favourably reviewed by the UK's highly critical specialist computer press, the 520ST is likely to make a great impact in this country as a sophisticated alternative to an IBM PC, APRICOT or APPLE MACINTOSH. Unlike its overpriced competitors, the Atari 520ST can be linked up to a colour monitor to unleash a choice of up to 512 colours. The addition of colour brings out the full potential of graphics packages such as GEM.

USER FRIENDLY GEM OPERATING SYSTEM

The power of the ST is harnessed and made user friendly by the new operating system 'GEM' from Digital Research. GEM stands for Graphics Environment Manager and allows a user friendly colour or B/W graphics interface which closely resembles that of the Macintosh. This similarity extends to the use of moveable resizeable windows, icons to represent objects such as disks and disk drives, and the use of pull down menus and a mouse. The advantage of all this is that the computer becomes extremely easy to use. GEM has now been implemented for the Acorn, ACT, Atari, IBM, ICL, and Olivetti. Software written for GEM on one computer should also run under GEM on another computer. This will enable the market to quickly produce a large library of standard interchangeable software.

FREE SOFTWARE AND FUTURE EXPANSION

The Atari 520ST comes supplied with seven free software packages as listed below: 1) TOS -Tramiel Operating System based on CPM 68K. 2) GEM Graphics Environment Manager by Digital Research (DR) giving a WIMP (Window, Icon, Mouse, Pull down menu) environment. 3) DR GEM Paint for creating graphics masterpieces. 4) DR GEM Write for word processing. 5) Logo learning language to enable you to write your own programs easily using turtle graphics. 6) DR Personal Basic a powerful user friendly version of the Basic programming language. 7) BOS operating system giving you access to dozens of business applications packages already available on the market. Designed with future expansion in mind, the ST also features a host of different interfaces to the outside world and an impressive list of accessories is planned. Atari will soon be releasing a 1000K (1MB) 3½ inch disk drive, and a 15MB hard disk storage system as well as a mass storage compact disk (CD) player capable of storing an entire 20 volume encyclopedia on one disk. A full range of inexpensive printers are planned including dot matrix, daisywheel and thermal colour printers. With its unbeatable graphics, speed and software at a price which is far below that of any comparable personal computer currently on the market, the ST is all set to do battle with the competition. To receive further details of the ST from Silica Shop, just fill in the coupon below with your name and address details and post it to us.

Silica Shop Price: £651.30 + £97.70 VAT = £749.00 This price includes:

- ★512K RAM
- ★B/W MONITOR
- ★MOUSE
- ★500K 3.5" DISK DRIVE
- ★GEM
- ★KEYBOARD (95 KEYS)

£749

ATARI 520ST SPECIFICATION

MEMORY
512K RAM (524,288 bytes)
16K ROM expandable to 320K
Port for addnl 128K plug-in ROM cartridges
200K TOS operating system

GRAPHICS
Individually addressable 32K bit-mapped screen with 3 screen graphics modes:
320x200 pixels in 16 colours (low resolution)
640x200 pixels in 4 colours (med resolution)
640x400 pixels in monochrome (high res)
16 shades of grey in low res mode
512 colours available in low/medium res
8 levels of each in red, green and blue

ARCHITECTURE
4 custom designed chips:
GLUE Chip - MMU Memory Mngmnt Unit
DMA Controller - Graphics Processing Unit
16/32 bit Motorola 68000 processor at 8MHz
eight 32 bit data registers
eight 32 bit address registers
16 bit data bus/24 bit address bus
7 levels of interrupts/56 instructions
14 addressing modes/5 data types

DATA STORAGE
High speed hard disk interface
Direct memory access 1.33 Mbytes per second
CD (Compact Disc) interface
Built in cartridge access
Dedicated floppy disk controller

DISK DRIVE
500K (unformatted) s/sided 3½" floppy d/drive
349K (formatted) storage capacity

SOUND AND MUSIC
Sound Generator
Frequency control from 30Hz to above audible
3 voices (channels) in wave shaping sound in addition to a noise generator
Separate frequency and volume controls
Dynamic envelope controls
ADSR (Attack, Decay, Sustain, Release)
Noise generator
MIDI interface for external music synthesizers

KEYBOARD
Separate keyboard microprocessor
Standard QWERTY typewriter styling
Ergonomic angle and height
95 keys including 10 function keys
Numeric keypad — 18 keys including ENTER
One touch cursor control keypad

MONITOR
12" screen - high res monochrome monitor
640x400 monochrome resolution

VIDEO PORTS
Display - Low Resolution - 40 columns
Med/High Res - 40/80 plus cols
Medium res RGB (Red/Green/Blue) output
High resolution monochrome (Black & White)

COMMUNICATIONS
Bidirectional centronics parallel interface for printers, or modems capable of input/output
RS232C serial modem/printer interface
VT52 Terminal Emulation Software
Maximum Baud Rate up to 19,200
High speed hard disk interface
Floppy disk controller (Western Digital)
2 joystick ports (one for 2 button mouse)
MIDI interface for external music synthesizers

GEM WIMP ENVIRONMENT
WIMP - Window Icon Mouse Pop-down menus
Two button mouse controller
Icons/Pull down menus/Windows
GEM VDI - Virtual Device Interface
GEM AES - Application Environment Services
GEM BBT - Bit Block Transfer
Real time clock & calendar

SOFTWARE
GEM environment
with user friendly Macintosh style operation
'TOS' - Tramiel Operating System
Atari's own system based on CP/M 68K with hierarchical directory & file structure plus a host of MS DOS & UNIX command structures
'BOS' - Business Operating System
to run any standard BOS business programs
GEM desktop
with GEM PAINT graphics mgmt system and GEM WRITE word processor
Personal BASIC and DR Logo
originally written by Digital Research (DR) Very much like those on other machines except for the extensive use of pull down menus, mouse control and windows

VARIOUS
Dimensions: 470mmx240mmx80mm
Replaceable external power supplies
Expansion: 3½" floppy disk drives 500K/1,000K (two drives can be connected)
3½" 15Mb hard disk
CD (compact laser disc)
Dot matrix & d/wheel prntrs (black)
Thermal dot matrix (colour)
RGB & monochrome monitors

LANGUAGES
BASIC & LOGO supplied
Many others will soon be available, including: Assembler, BCPL, C, Cobol, Compiled Basic Lisp, Modular-2 and Pascal

Note: Some of the above specifications are pre-release and may therefore be subject to change

MACINTOSH v F1e v 520ST

"Imagine a Fat Mac - the 512K Apple Macintosh - but with a bigger screen, a far bigger keyboard with numeric keypad, cursor and function keys, and colour. That gives you some idea of what the Atari 520ST is like, except for two important things. First the Atari seems faster. Second the Atari system is about one third of the price."
June 1985 - Jack Schofield - **PRACTICAL COMPUTING**

	APPLE	APRICOT	ATARI
FEATURES OF BASIC SYSTEM	**MACINTOSH**	**F1e**	**520ST**
Price Includes B/W Monitor	YES	NO - extra £200	YES
Keyboard size mm (LxDxH)	330x147x50	450x167x28	470x240x60
Keyboard size ins (LxDxH)	13x5¾x2	17½x6½x1	18½x9½x2½
3½" D/Drive (Unformatted)	500K	500K	500K
3½" D/Drive (Formatted)	399K	315K	349K
WIMP (Window, Icon, Mouse ...)	Apple	ACT - Activity	GEM
Real-time Clock	YES	YES	YES
Polyphonic Sound Generator	YES	NO	YES
RS232 Serial Port	YES	YES	YES
Centronics Parallel Printer Port	NO	YES	YES
Dedicated Floppy Disk Controller	NO	YES	YES
Hard Disk DMA Interface	NO	YES	YES
Full stroke keyboard	YES	YES	YES
Number of keys on keyboard	59	92	95
Numeric Keypad	NO	YES (16 Keys)	YES (18 keys)
Cursor Control Keypad	NO	YES	YES
Function keys	NO	10	10
16-bit processor	68000	Intel 8086	68000
Processor running speed	8MHz	4.77MHz	8MHz
RAM size	512K	256K	512K
Number of graphics modes	1	4	3
Number of colours	Monochrome	16	512
Max Screen Resolution (pixels)	512 x 342	640 x 256	640 x 400
Mouse included	Single Button	NO - extra £95	Two Button
Replaceable External Power Pack	NO	NO	YES
Cartridge Socket	NO	NO	YES
Joystick Ports	NO	NO	YES (two)
MIDI Synthesiser Interface	NO	NO	YES
Monitor Size	9"	9" - extra £200	12"
RGB Video Output	NO	YES	YES

System Cost with: Mouse - Monochrome Monitor - 512K RAM - 500K Disk Drive

Price of basic system (exc VAT)	£2595+VAT	£595+VAT	£652+VAT
+ Mouse	Included	£95+VAT	Included
+ Monochrome Monitor	Included	£200+VAT	Included
+ Expansion to 512K RAM	Included	£295+VAT	Included
Price of complete system (exc VAT)	£2595+VAT	£1185+VAT	£652+VAT
PRICE rounded down including VAT	**£2,984**	**£1,362**	**£749**

PRESS COMMENT

"Atari's new corporate image as an aggressive low cost computer maker is likely to mirror that of Commodore where Mr. Tramiel established the maxim that 'Business is war'."
August 21st 1984 **FINANCIAL TIMES**

"This is the only personal computer I know of that comes with a Midi interface as standard."
Peter Bright March 1985 **PERSONAL COMPUTER WORLD**

"The (GEM) version running on the Atari 68000 machines will have the additional advantage of leaving the PC version standing."
April 6th 1985 **PERSONAL COMPUTER NEWS**

"It would seem that GEM offers the ideal operating system."
March 7th 1985 **POPULAR COMPUTING WEEKLY**

"I found it (GEM) extremely easy to use and was very impressed with the way in which it disguises the unfriendly hardware and operating systems lurking under the surface."
Peter Bright Feb 1985 **PERSONAL COMPUTER WORLD**

"The electronics in the machine are a work of art .... The heart of the 520ST is a Motorola 68000, one of the most powerful 16-bit processors around and in many respects it is close to being a 32-bit chip ... when the machine appears in the shops, I'll be at the front end of the queue to buy one."
Peter Bright June 1985 **PERSONAL COMPUTER WORLD**

"This machine is significantly more powerful than an IBM PC ... If it's possible to design a sure-fire winning machine, this is it."
May 11th 1985 **PERSONAL COMPUTER NEWS**

"... the use of GEM makes the new range of Atari computers so similar to the Macintosh (with the added attraction of colour), that they are already being called 'Jackintoshes'."
May 2nd 1985 **COMPUTING**

"The new Atari ST computers truly represent to the consumer what Jack Tramiel is saying — easy-to-use computing power without the price."
March 1985 **ANALOG COMPUTING**

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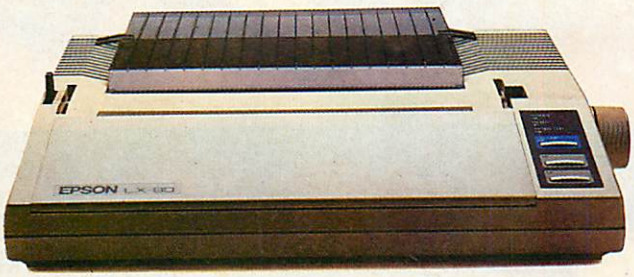

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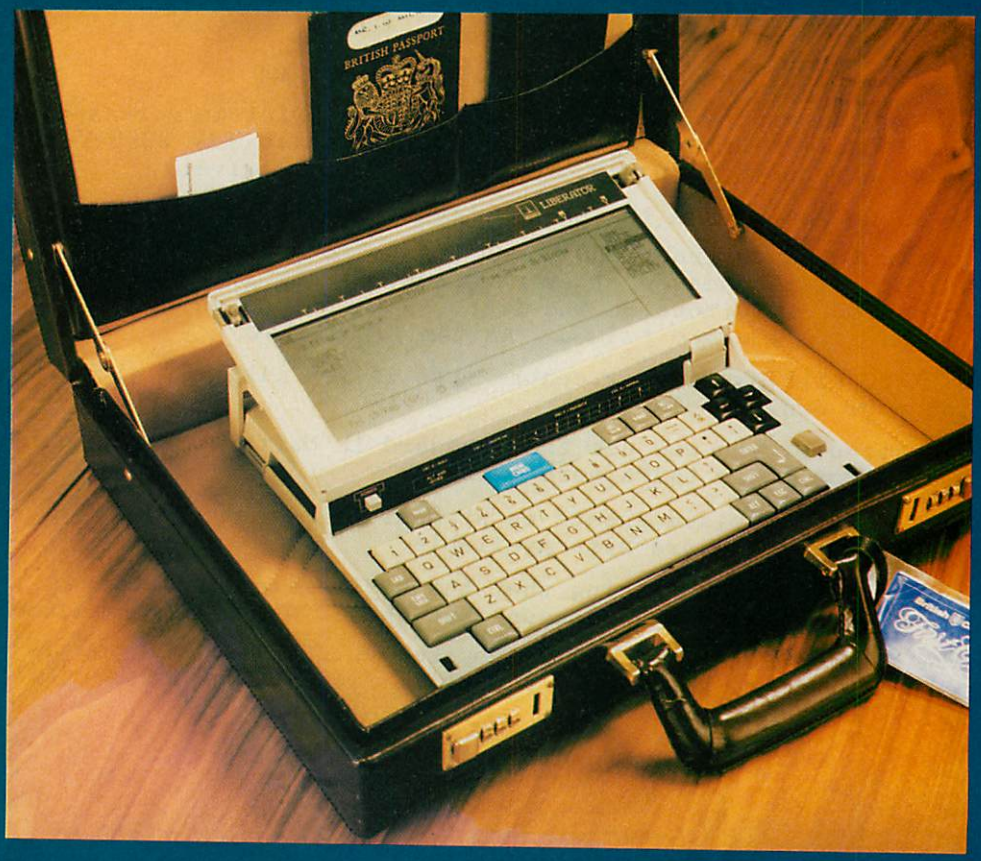

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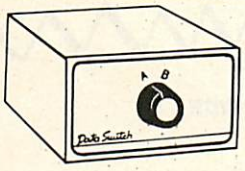

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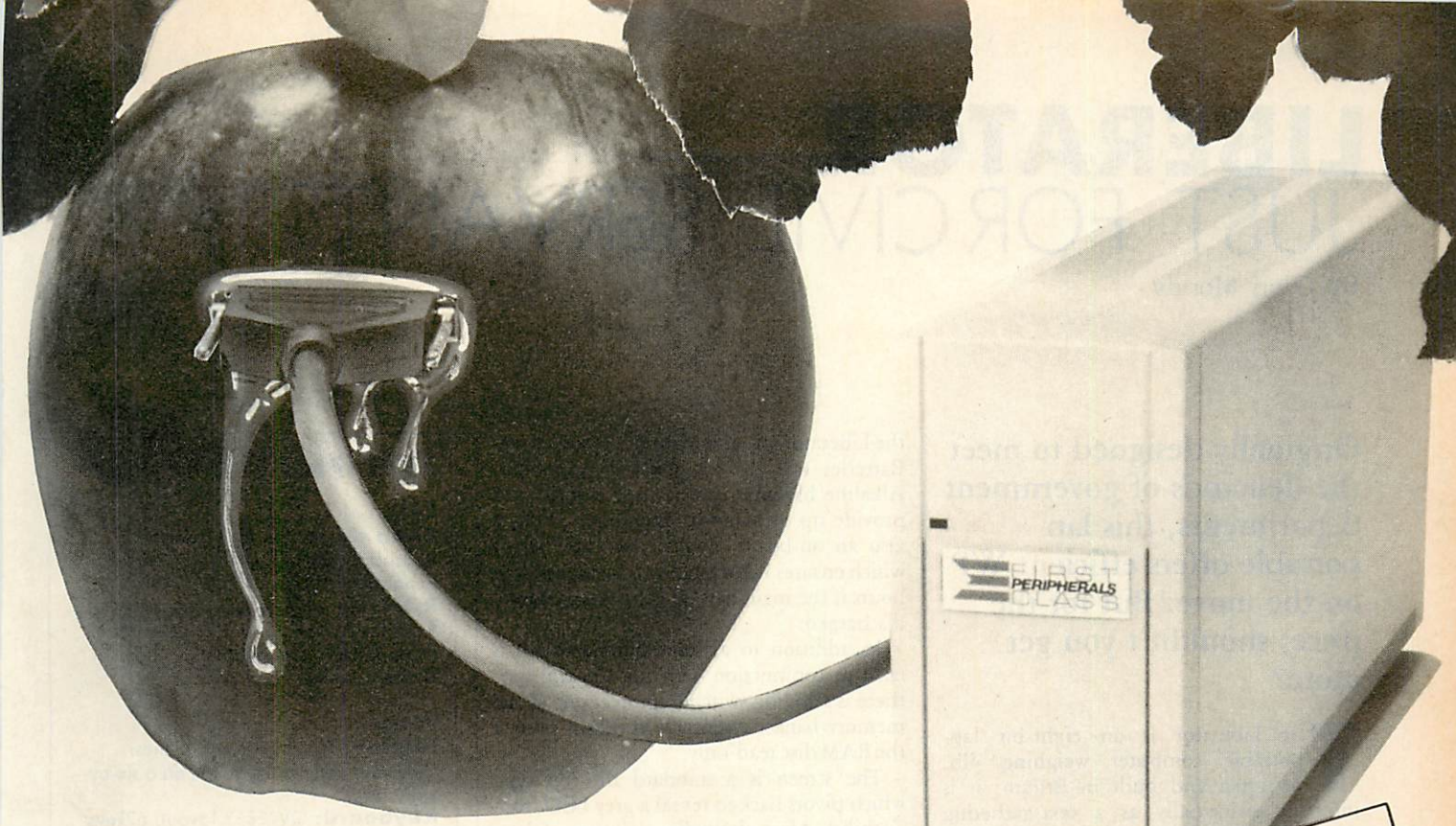

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LIBERATOR
JUST FOR CIVIL SERVANTS?

By Glyn Moody

Originally designed to meet the demands of government departments, this lap portable offers efficient WP on the move. But for the price, shouldn't you get more?

The Liberator is an eight-bit lap-portable computer weighing 4lb. designed and built in Britain; it is intended principally as a text-gathering device. The price is £720.

It arose out of studies of lap portables that was carried out by the government's Central Computer and Telecommunications Agency, the CCTA. This is part of the Treasury and is responsible for evaluating and purchasing new technology and computers for all government departments.

Three machines built by the Japanese firm Kyocera, and sold as the Olivetti M-10, NEC 8201 and Tandy 100, were tried out by a number of civil servants. Their verdict was that lap portables could save considerable time and cost in preparing reports, especially by those who travel a lot in their work. Consequently, the Department of Trade and Industry discussed with British computer manufacturers the possibility of producing a version to meet the government departments' needs. This blossomed into the Liberator project at Thorn EMI.

The final form of the Liberator has been largely shaped by its history. It weighs a mere 4lb., is only 1.4in. thick, and fits easily in a briefcase. The review model was a dull grey, but retail machines will be moulded in cream-coloured plastic. It is intended chiefly as a text-gathering device: the word processor is resident on ROM, and is the only application currently available. An external ROM socket allows others to be added later.

EXPANSION PORTS

At the back of the machine, there is a RAM slot for inserting 24K cartridges. The basic machine comes with 40K RAM which can be expanded to 64K internally. Also at the back there are two serial ports, one for a printer and one for comms. Unfortunately, these both use eight-pin DIN plugs rather than RS-232s, though Thorn EMI provides leads ending in RS-232 plugs as an alternative.

A battery socket allows the Nicad batteries to be recharged; this takes five hours with the Liberator off, and eight hours with it on. Batteries will last 12 hours in operation. Alkaline batteries can be used instead and provide up to 16 hours operation. There is also an on-board memory backup battery which ensures RAM retention for at least five hours if the main battery is removed or fully discharged.

In addition to a Reset button which is used in conjunction with the Control key, there is a sliding switch to protect one of the memory banks; essentially it makes part of the RAM disc read-only.

The screen is a standard flip-top type which pivots back to reveal a grey LCD from Toshiba. After about five minutes of keyboard inactivity the screen powers down to save the batteries. To revive it, there is a screen-refresh button above the keyboard to the left. Unfortunately, there is no ratchet device on the screen to allow you to adjust the angle of viewing. Instead, the carrying handle which pulls out from the rear of the machine folds over and forms a rest for the screen.

LIBERATOR

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	☐	■
Documentation	☐	☐	■	☐
Value for money	☐	■	☐	☐

☐ If your main need is for a very lightweight, portable word processor and cost is no great problem the Liberator will fit the bill.

Generally, the standard of workmanship on the review model was not equal to that on similar Japanese machines. For example, the various sections of the moulding at the back are not totally flush, and the sprung door on the RAM port is wonky. Thorn EMI says that the machines which will be sold to the public have better tolerances and overall finish.

The keyboard is of good quality, with dished keys. The layout is unusual. As well as the standard QWERTY keyboard, there are four cursor keys in the top right-hand corner, and a number of function keys along the top. These include Left and Right Delete, a toggle between Overwrite and Insert, and a block marker button.

The machine is switched on by opening the lid, and it beeps when you do so. The initial screen displays the files present in bank A of the RAM, the number of free blocks – each block represents about 1K – the date and the time. On the right-hand side of the screen there is a short menu of commands: Bank, Delete, File, Newfile, Print, Protect, Rename, Setprint and Utility. You move around these with the up and down cursor controls.

Most of the commands are obvious. Bank sets the bank of RAM: Bank A and B refer to the partitioning of the RAM, and Bank C to any extra RAM packs which may be resident in the RAM port. Protect enables you to place a marker in the form of a shield against selected files, and inserts an extra level of protection. Setprint allows you to choose between dot-matrix and daisywheel printers. Utility calls up a sub-menu with subsidiary commands handling such things as comms and setting the internal clock.

Since the Liberator is intended as a dedicated word-processing machine, all the commands place you automatically in text-entry mode. Operation of the program is simplicity itself. Using Shift and Control keys in conjunction with the cursor pad allows you to move in any direction by letter, word or screen. Similarly deletions can be a letter or line at a time.

Commands like block moves and word

SPECIFICATION

CPU: CMOS Z-80
RAM: 40K on standard machine, upgradable to 64K internally; external expansion of 24K
ROM: 32K operating system; external ROMs will offer applications such as spreadsheets, comms, etc.
Dimensions: 252mm (9.9in.) x 295mm. (11.6in.) x 35mm. (1.4in.)
Weight: 4.2lb. (1.9kg.)
Display: 80 columns by 16 lines; character cell five-by-seven on a six-by-eight grid
Keyboard: QWERTY layout; 62keys, including four cursor keys
Interfaces: two serial interfaces, RAM expansion port, ROM expansion slot, battery-charging socket
Software in price: operating system, based on Personal CP/M, word processor
Software options: full comms and spreadsheet ROMs may be available in due course
Price: £720 plus VAT for basic system; RAM packs £115
Manufacturer: Thorn EMI Dynatel, Treorchy, Mid-Glamorgan CF42 6EY. Telephone (0443) 435273

searches are handled from another small menu, called up by pressing the blue Break/Command key placed centrally above the keyboard. The menu appears down the right-hand side of the screen. One of the two default settings for screen width allows this menu to be present without obscuring any text. The wider setting means that the menu is pulled down over the right-hand part of it.

Blocks are marked using the dedicated marker key placed to the left above the keyboard. It is then simply a matter of using the appropriate command from the subsidiary menu. From the same menu you can also search for words, return to the main menu or print out a document. Printing is also very straightforward. Thorn EMI sells two badge-engineered dedicated printers, a daisywheel from Itoh, and a Fujitsu dot-matrix. However, with the the RS-232 lead you can use other standard serial printers such as those from Epson.

In use, the Liberator proves well suited to its basic task of word processing. The keyboard has a good feel to it, and can be used by touch-typists without problem. Minor grouses include the positioning of the Shift and Enter keys and the layout of the Delete group. In time you get used to the position of Backspace Delete, but it could be more convenient.

LCD SCREEN

The screen, too, is very good for its type. I have yet to come across an LCD I would really like to work with for long periods, but the Liberator's is acceptable. It is a pity that it is not possible to adjust the screen position more finely, and many will doubtless find the preset angle is wrong for them.

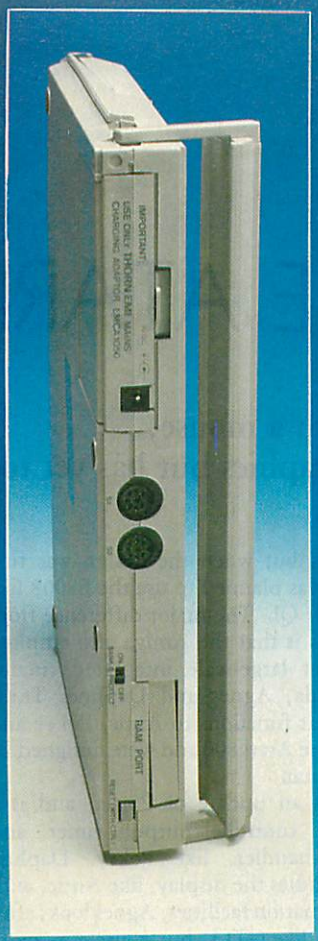
The word processor itself is adequate. It does most of the things you would like and is quite fast. Limitations include only two page-width settings, and no replace facility to be used in conjunction with the search.

Perhaps the main problem with the machine is that it is only a word processor. There is no electronic mail — though Thorn EMI hopes to release this very soon — and no other programs to run on it. This places it at a considerable disadvantage to its Japanese rivals. Even if additional features do come through, Japanese technology and products are almost certain to have moved on yet further, and prices to have come down.

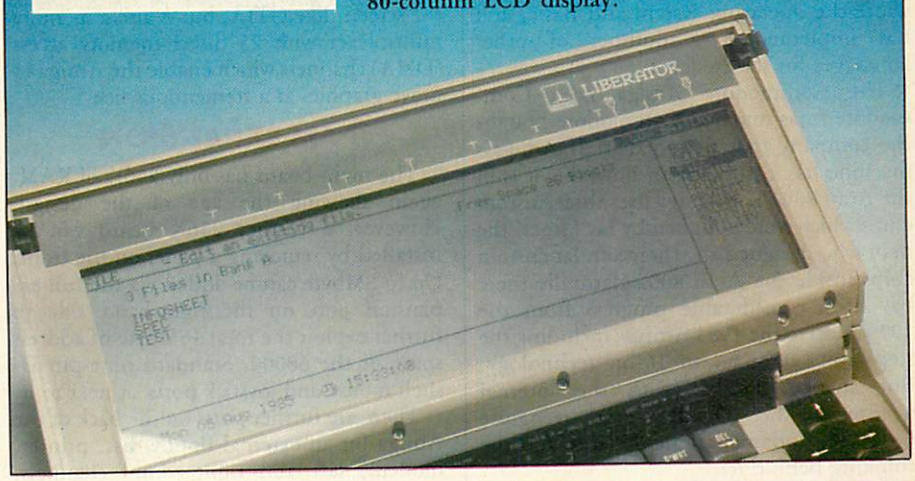
The Liberator can only be recommended over its rivals if its particular virtues are paramount for you and you really only want a text-gathering device which is very light and very slim.

CONCLUSIONS

- The Liberator is a slim, lightweight lap portable designed mainly for word processing on the move.
- The machine suffers from being limited to one application, and from its lack of electronic mail facilities but the manufacturer says it is working on these areas.
- The keyboard and screen are of a high quality, and the word-processing program is very usable, if somewhat limited.
- Compared to its rivals, the Liberator looks rather overpriced. PC



A large, legible screen was one of the requirements revealed by a CCTA study. Accordingly the Liberator has a clear, 16-line by 80-column LCD display.



THE LIBERATOR AND ITS RIVALS

The lap-portable market which the Liberator is entering is a crowded one. In the same price bracket there is the highly thought of Epson PX-8 and the new Tandy 200, as well as variants of the Kyocera machine from NEC, Olivetti and Tandy which are at prices well below it.

The Epson has a smaller LCD of only eight lines of 80 columns, but it possesses a number of attractive features. These include CP/M with 64K RAM, programs like WordStar and Microsoft Basic, plus a spreadsheet and a database on plug-in ROM chips. In addition to a built-in microcassette drive, you can also buy a battery-powered microfloppy.

The Tandy 200 offers a 16-line by 40-character screen, 24K RAM expandable to 72K, and 72K of ROM which includes Multiplan and a text editor. A big plus is the on-board modem, though BABT approval has not come through yet. The Tandy 200 is the complement of the Liberator, which lacks both modem and spreadsheet but does have better word-processing facilities.

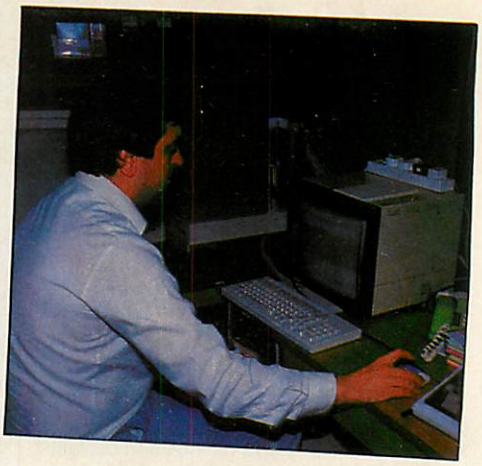
Lower down the scale, the three variants of the Kyocera machine offer basic lap-portable facilities for about half the price of the Liberator. The screen has an eight-line by 40-character LCD. The Liberator scores over them in having a full word processor rather than a simple text editor, and better storage facilities. However it lacks the programs and Basic available for the other machines.

Epson is on 01-902 8892; Tandy on (0922) 648181; and Olivetti on 01-785 6666.

AMIGA COMMODORE REINVENTS THE ATARI

By Jack Schofield

This 68000-based machine comes with a mouse, text-to-speech capability and great graphics but has yet to prove itself in a tough market.



Tim King with Amiga developent system.

Commodore U.K. is doing its best to ignore the Amiga Lorraine computer, first announced two years ago, and finally launched in New York at the end of July. This is because the Amiga is built round a chip that handles NTSC video, and a Pal version will not be availble until next year.

However, it is such an interesting and potentially important micro that it is worth previewing. This report is based on a day spent with Metacomco in Bristol. This small British software house has two development machines and one final Amiga. Metacomco wrote the operating system and Basic, and has implemented a number of other languages for release later.

The Commodore Amiga is a Commodore in as much as Commodore bought the company that designed it. If Amiga's machine has a true origin, however, it is in the Atari 800. The Amiga uses three custom chips which were designed by Jay Miner, the man who designed the three similar custom chips inside the Atari 800. Naturally there has been considerable progress from the 1979 Atari to the 1985 Amiga, including the step from eight-bit to 16-bit technology. But anyone familiar with the internal workings of the 800 will instantly recognise both the fundamental architecture and the thinking behind it.

MARKETING STRATEGY

However, sales of the Atari 800 indicate there may be a problem marketing a machine that very few people understand. The Atari 800 lost out to a technically inferior machine — the Commodore 64 — which was both cheaper and had more memory. History could be about to repeat itself in the forthcoming battle between the Amiga and the Atari 520ST where, this time, it is the Atari that is half the price, has twice the memory, and has Jack Tramiel marketing it.

The Amiga is a compact machine with a detached keyboard and built-in 3.5in. disc drive. In size and appearance it is very similar to the Research Machines Nimbus and Philips' new Yes. Both of these use the Intel 80186 chip, to preserve some compatibility with the standard MS-DOS and IBM PC machines.

However, the Amiga, uses the Motorola 68000, like the Atari 520ST and Apple Macintosh, but when the design was first started it was planned to use the 68008 like the Sinclair QL. The major difference from these rivals is that the Amiga also employs three other large-scale integrated circuits called Paula, Agnes and Daphne. These have similar functions to Antic, Pokey and GTIA in the Atari 800 and were designed by the same man.

Paula is an update of Portia, and is a peripheral controller/output timer and interrupt handler, like Pokey. Daphne mainly handles the display, like Antic, with added animation facilities. Agnes looks after the screen, like GTIA, but is also a memory multiplexer with 25 direct memory access (DMA) channels which enable the Amiga to move graphics at a tremendous lick.

RAM EXPANSION

The main board has only 256K of RAM, again showing the age of the design. However, a further 256K board can be installed by removing a panel on the front. Up to 8Mbyte can be added via the full expansion port on the right-hand side to further exploit the total 16Mbyte of address space of the 68000. Standard nine-pin D-shell mouse and joystick ports sit next to it.

There are further ports on the back of the Amiga for an external floppy disc, printer, modem, left and right sound channels, video display and the keyboard.

The detached keyboard is on a coiled cable. The key layout is Selectric in style. Also there are 10 function keys along the top, and a 14-key numeric pad on the far right. A cross-shaped cursor-control block nestles next to the right Shift and oversized Return keys. Finally there are two extra Amiga keys, one at each end of the space bar, rather in the Apple style.

In use the keyboard has a good feel, though the keys themselves feel slightly small. It is most reminiscent of the keyboards supplied with the Tandy 1000 and 2000 micros, and rather better than either the Atari 520ST or Apple Macintosh.

The third hardware element will normally be the Commodore monitor, which is priced separately. Reports suggest this has an outstanding performance. However, the final display quality will in part depend on how the U.K. version of the video chip is implemented.

Another feature is a text-to-speech capability which sounds slightly better than the usual Dalek in a dustbin. It offers a choice of male and female voices and the software is intelligent enough to add an element of intonation, which is a real breakthrough.

There are two main elements to the software: the operating system, Amigados, and the icon-orientated user interface, Intuition. Amigados started life in Cambridge in 1976, about the time the Cambridge Ring was being developed. It was called, at the time, Tripos, after the examination. Its chief merits were that it was small, designed to be portable, and multi-tasking. The Tripos kernel was developed further at the University of Bath by Dr Tim King and others. Later, Metacomco was formed to exploit the operating system and other software, under a royalty agreement. Further development at Metacomco has customised it to the Amiga. At Metacomco, Tripos is also run on Sage/Stride and other 68000-based systems. Dr King says it could be put on to the Atari 520ST, for which Metacomco also wrote the Basic.

Amigados is a Unix-like operating system — it recognises List but not Dir — written in BCPL. It offers an unlimited number of files, a hierarchical file structure, hashed disc directories and lots of Unix-like transient utilities. It remains to be seen how many of these will be delivered with Amigados, but the whole lot only occupies a few hundred K rather than 5Mbyte like Unix.

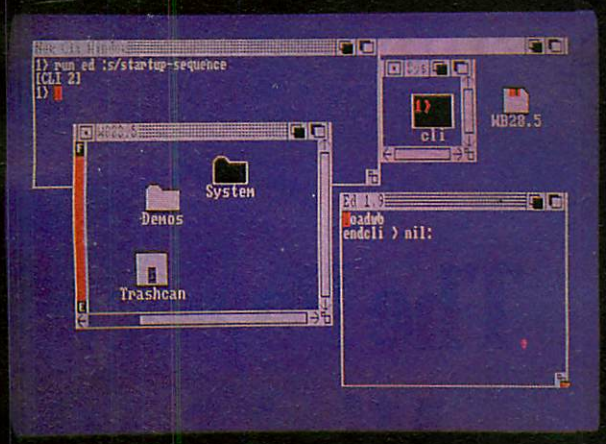
RUNNING AMIGADOS

Amigados can be driven from a command-line interpreter, just like a proper computer. The only major difference is that when you type, say, Run Prog, you can get the command prompt back straight away. You can then issue other commands. Meanwhile the operating system continues in the background to load Prog from disc and run it, etc. The prompt goes through 1> to 2> then 3> as you open windows and add tasks.

However, most Amiga users will see relatively little of Amigados. Instead they will see the bit-mapped graphics front end, Intuition, which is a Wimp interface complete with windows, icons and mouse pointers. The obvious comparisons are with the Apple Macintosh, DR Gem and, if it ever comes, Microsoft Windows.

Though taking up 32K of screen RAM,

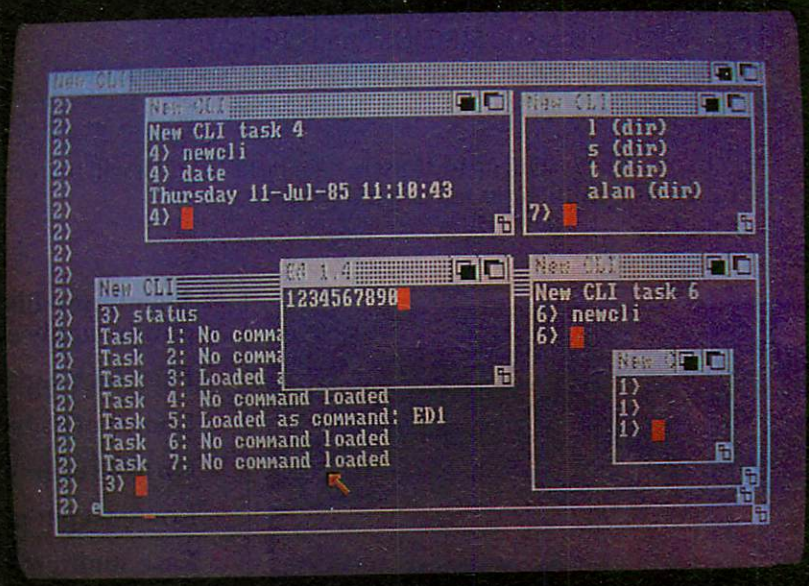
(continued on page 65)



Intuition, the Amiga's user-friendly front end, is shown here in the default colour settings. The icons look relatively crude compared to the Macintosh and Gem versions in monochrome.

Amigados can be run from a traditional command line interpreter (CLI). Note the exchange "Can't rename Peter as Fred". When you type "Why" the system replies. Try that with CP/M!

Amigados is multi-tasking. This means, for example, that when you are word processing you can open a window — shown here as New CLI — in order to look up an address in a database file.



Amigados lets you open as many windows as you like. There is no limit to the number of tasks as long as you have enough memory. Though the Amiga has only 256K to start, it can access 8Mbyte.

The ABasic program below allows freehand drawing with the mouse. The "line" is the sequence boxes that makes up "Practical Computing" in the output shown here. Peno is the outline pen colour. The b% in line 20 checks the mouse button. The 1 at the end of line 30 provides the graphics fill.

```
5    scnclr
10   pena 2
15   peno 1
20   askmouse x%, y%, b%
25   if b% = 0 goto 20
30   box(x%-5, y%-5; x%+5, y%+5),1
35   goto 20
```

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(continued from page 63)

Intuition looks relatively crude, mainly because it is drawn in colour with the 640- by 200-pixel resolution of an IBM PC. The fine black-on-white lines of the Macintosh and Atari in monochrome mode look much smarter. However, Intuition does have some real advantages. For example, something looking like a fuel gauge down the side of each window shows the memory being used. Also an icon can actually be taken out of a window, though if you select it afterwards you may still have to replace the disc to make the code accessible. Multiple tasks can be run live in different windows, which can be switched from front to back like on the Lisa. This is quite unlike the Atari 520ST where processing stops when you merely move the mouse to a menu. Tasks keep running on the Amiga, even when you cannot see them. Intuition is up to at least version 28.14 and seems reasonably fully debugged.

It can be set up so that a layer library keeps a damage list, or record of overlapped screen areas. This means you can switch screens instantly in exchange for a small memory overhead. It is claimed that the only limitation on the number of windows and number of tasks which can be run concurrently is the amount of memory available.

Instead of coming with a bundle of useful software like the Macintosh and Atari 520ST, it seems the Amiga will mainly have DOS and Basic. The Basic which runs at the moment, and which was demonstrated at the New York launch, is derived from Metacomco's Basic written in C. However, Commodore announced a Microsoft Basic at the launch, even though — according to Tim King — it demonstrated Metacomco's version.

METACOMCO'S BASIC

Metacomco's Basic is sold by Digital Research as Personal Basic, and is one of the languages supplied with the Atari 520ST. As PBasic it has not made much impact, partly because it does not have well-developed graphics commands. Extensions are in hand to add these to the Atari version. The Amiga version, ABasic or ABC, has them already.

ABasic shows the one fundamental difference between the Amiga and the Atari 800, as follows. All the sophistication in the Atari 800 was there so that Atari's arcade experts could implement brilliant games on the machine, and sell them to users for £35 each. Users were not given a Basic at all, and the primitive 8K Atari Basic — an optional extra — offered few hooks into the custom chips. However, in the Amiga, ordinary users are provided with commands like Animate. This allows you to stick a series of sprites into an array and produce super graphics animation. ABasic can also communicate with DOS using the Unix-like Shell " command, as in IBM PC-DOS 2, where it is undocumented, and DOS 3.

Other software to be promised includes all Infocom's adventures, most games from Electronic Arts and others from Broderbund. More serious software is to include Lattice C, Turbo Pascal, Logo, Enable, and the accounts packages from Chang Laboratories.

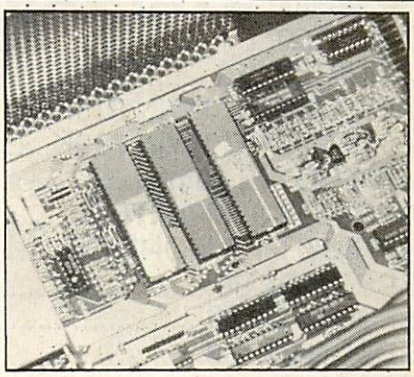
OTHER LANGUAGES

Metacomco has implemented an assembler and a Lisp which can have interpreted and compiled routines co-resident. A Pascal compiler is planned, and BCPL might follow. Several of these languages are already familiar from Metacomco's versions which are already available for the Sinclair QL.

Just how much software will really become available depends on sales. However, the Pal video display problems and delayed U.K. launch will mean American software houses have a considerable start on U.K. ones. With the Atari 520ST, things are more evently matched.

Commodore plans to offer a genlock device which will allow video images to be displayed and overlaid with computer graphics. Another $500 add-on is intended to provide a limited compatibility with the IBM PC. However, this is a strategic product — that is, it makes users feel there is an upgrade path without many people actually being expected to buy it. The usual array of hard discs and CD-ROMs is also promised, as for the Atari 520ST.

Those familiar with the Atari 800 will understand its player-missile graphics and the concepts of a playfield with sprites, and the use of graphics indirection through colour registers. The Amiga shares these concepts, though they have been taken much further. The Atari 800 can do, in 8K of code, what takes either 40K on, say, a Spectrum, or is impossible. The Amiga offers quadruple the power of the Atari 800 or maybe more. In other words, the Amiga is the world's greatest games computer. The problem is, how many people want to pay $1,895 for a games computer?



SPECIFICATION

CPU: Motorola 68000 running at 7.16MHz
Other chips: Paula, Agnes and Daphne custom chips
RAM: 256K, expandable to 512K
ROM: 128K or 192K
Display: 80 by 25 characters for monitor, 60 by 25 for TV; five display modes from 640 by 200 with 16 colours to 320 by 200 in 32 colours; colours from a palette of 4,096; eight graphics sprites
Sound: four channels with 16-bit resolution and envelope control
Storage: built-in 3.5in. microfloppy disc storing 880K
Keyboard: 89-key detached with 10 function keys, numeric pad and cursor keys
Ports: mouse, joystick, floppy disc, Centronics printer, two audio ports for stereo, RGB analogue, RGBI, NTSC composite video
Special features: text-to-speech capability
Software included: Intuition user interface, Amigados, ABasic
Supplier: Commodore International, 1200 Wilson Drive, West Chester, Pa 19380. Telephone: (U.S. area code 215) 431-9100
Availability: not in U.K. before 1986
Price: £1,295; monitor $600 extra

There is no doubt that good business micros are getting closer and closer to being good games machines. Colour, bit-mapped graphics and sound should all be part of the new user-friendly Wimp interfaces. However, they need suitable software; they are no use at all if you just want to run dBase II and WordStar.

So if the Amiga is to be a success as a serious computer, there must be some new types of program written to take advantage of its multi-tasking facilities. In fact, the Amiga starts off rather worse than the Macintosh and Atari 520ST in this regard. And once the games houses get hold of it, it may never recover.

We have already seen one breakway from Atari produce a brilliant graphics machine, the Mindset. In spite of far more IBM PC compatibility than the Amiga, even more coverage in *Byte*, and lots of venture capital funding, it flopped. If Tramiel still ran Commodore and launched the Commodore 520ST before Atari came in with the Amiga with half the RAM at twice the price, who would you bet on then? PC

ATARI v. COMMODORE

Atari is suing Amiga for $100 million over the Amiga Lorraine. Atari alleges that it gave Amiga $500,000 to develop the special chips, and it took an option on Amiga shares. Amiga returned the money and sold out to Commodore. Atari's suit says that, according to the agreement, "Amiga shall not grant any other party a license to make use or sell chips or products" unless they are outside the video game and home-computer field and unless Atari shares in the proceeds. Amiga says the suit is "totally without merit".

However, it will be a surprise if the Amiga appears under the Commodore label. It is more likely to appear as an Amiga. Whether Atari gets a share of the profits, if any, remains to be seen, but the lawyers will not lose out on it.

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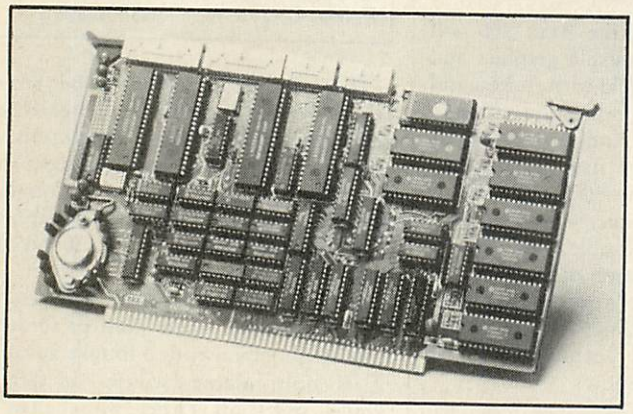

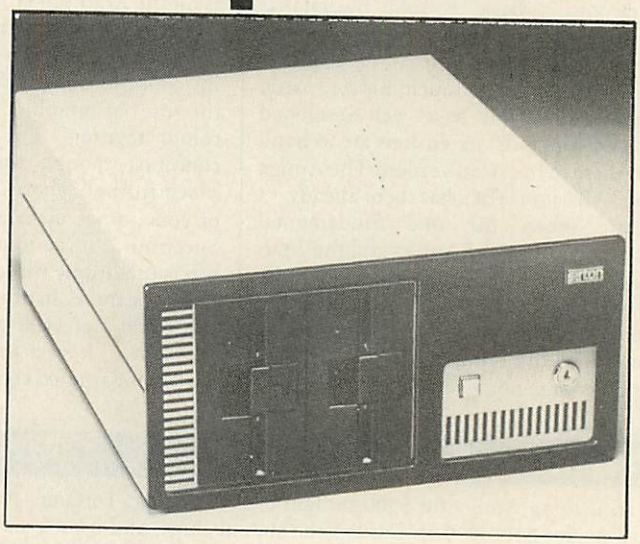

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APRICOT F10
KEEPING IT IN THE FAMILY

By Glyn Moody

This cheap hard-disc 512K RAM machine is the latest to join ACT's expanding range of micros.

When ACT launched the Apricot F1, it explained that F1 stood for "first one". The clear intention to launch some other ones has resulted in the F2 and F10 machines, both of which form part of the newly formed Apricot Collection.

The F2 adds a second floppy to the F1's single 3.5in. disc drive and costs £1,495; the F10 has a 10Mbyte Winchester and a price of £2,295, all prices without VDUs. Externally the F10 is almost identical to the earlier model. About the only change is the new Apricot logo, which ACT is doubtless hoping to turn into the micro equivalent of Lacoste. The main unit is still long and thin, and occupies amazingly little desk area, especially when you consider that there is a 10Mbyte Winchester in there as well as a floppy-disc drive, power supply and motherboard.

At the back there is the power socket, parallel port, serial interface and composite video output and a power supply for mono monitors. On the right-hand side, as on the F1, there is an external bus. As far as I know, no one has actually found a use for this yet. The combination of whirs from the Winchester and cooling fan produces a slightly intrusive background noise.

The main change from the earlier model is the keyboard. This is still a trendy infrared job, but the physical characteristics are quite different. Gone is the flat keyboard with contoured keys, the edges of which were close together, and only too easy to mis-hit. In its place is a more conventional design similar to the old Apricot PC with the addition of two rows of function keys on the right-hand side as on the F1's keyboard. The overall feel is much better; the new keyboard may still be slightly on the light side, but it is certainly quite usable for word processing.

The mouse proved to be a problem: the cursor movements produced by the example we had for review were very erratic and sometimes non-existent. The mouse should come into its own when used used with Digital Research's Gem, which is the other major change on the new machines. This replaces Activity, which is ACT's own icon-driven front end to MS-DOS.

Running the standard Basic Benchmarks shows almost identical performance with the F1, which is hardly surprising. This places the F series slightly behind the IBM PC in terms of speed, but not seriously. The implementation of Gem is not the zippiest around, but if you are sold on the idea of a Mac-alike front end, it is quite adequate. Unfortunately no manuals were available at the time of review, so it was not possible to appraise either them or the IBM emulation package normally offered with the machine.

So the F10 is not an earth-shattering breakthrough — rather a good, basic machine. Its importance probably lies in its consolidation of the whole Apricot family.

APRICOT F10

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	■	☐
Documentation	☐	☐	☐	☐
Value for money	☐	☐	■	☐

The Apricot F10 is a very compact MS-DOS machine which offers good performance for a low price.

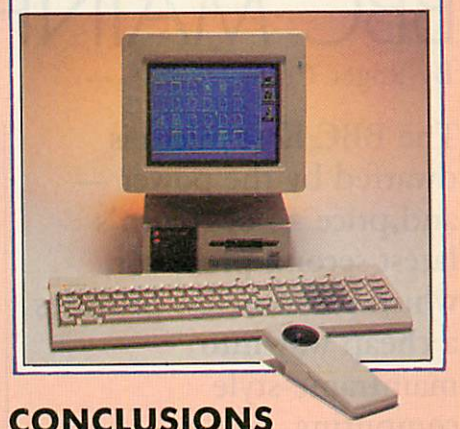
However, contrary to the company's statements, it seems likely to leave the older Apricot PC in all its versions — now renamed the Professional family — out on a limb and vulnerable to being dropped.

The price differential is small: the PC with two 720K floppies costs £1,795, and the XI with 10Mbyte £2,795. True, these both have monitors worth about £200, which the F machines lack, but they also only have 256K against 512K on the later models. Both machines are portable, though the PC does have handles on it. Otherwise, the main factor to be considered is likely to be the keyboard, which on the old PC is of sturdier workmanship and has a more substantial feel.

With the launch of the F2 and F10, and the rejigging of the Apricot family, there is now plenty of room for some new products in the upper reaches to take the company through the next few years. In particular an 80286-based machine would not go amiss. So far ACT has done very nicely outside the IBM fold, but it could well be time to join the club. It will be interesting to see what happens in the next few months.

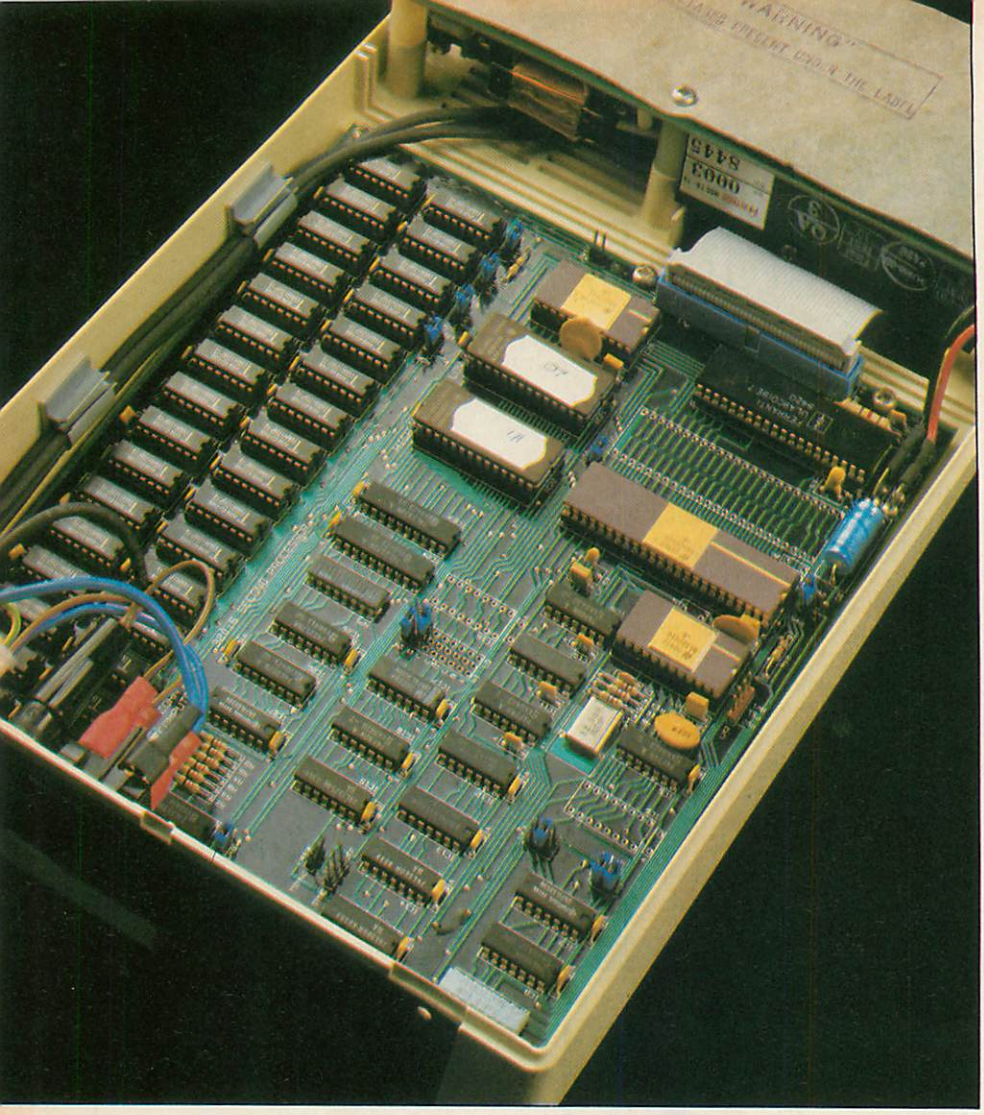
SPECIFICATION

CPU: 8086 running at 4.77MHz
RAM: 512K, expandable to 768K
Weight: systems unit 5.2kg. (11.4lb.) keyboard 1.32kg. (2.9lb.)
Dimensions: systems unit 420mm. (16.5in.) deep, 221mm. (8.7in.) wide, 160mm. (6.3in.) high
Keyboard: full-size QWERTY with numeric keypad and 10 function keys
Mass storage: one 3.5in. 720K floppy, 10Mbyte Winchester on F10; F2 has two 720K floppies
Interfaces: RS-232, Centronics, external bus, one internal expansion slot on F10, two on F2, colour and monochrome outputs; UHF output available on F2 via expansion card
Software in price: Gem Desktop, Paint, Write, Utilities, MS-DOS 2.11, GWBasic, IBM emulation package
Peripherals: mouse included in price, monitor extra; UHF expansion card for F2; combined LAN and memory expansion board
Price: F10 £2,295, F2 £1,495; all prices exclude VAT and monitors; 9in. monochrome monitor £200, 12in. £250, 10in. colour monitor £395
Manufacturer: Apricot U.K. Ltd, Shenstone House, Dudley Road, Halesowen, West Midlands B63 3NT. Telephone: 021-501 2284



CONCLUSIONS

- The Apricot F10 is a low-cost business machine which provides a neat MS-DOS solution with all the benefits of a hard disc, and a generous 512K of RAM.
- The keyboard is an improvement over the earlier F1, though the infrared link is still of dubious value.
- The implementation of Gem seems to work well, if a trifle slowly.
- With the launch of the F2 and F10, ACT has bolstered the Apricot family. It may lack IBM compatibility, but it does offer a very comprehensive range of options and clear upgrade paths. PC



CAMBRIDGE 32016 CO-PROCESSOR

BBC MAINFRAME ADD-ON

By Roger Cullis

The BBC host micro is dwarfed by the power — and price — of Acorn's latest second processor, which nevertheless provides a cheap way into mainframe-style computing.

After a gestation period longer than that of an elephant, Acorn has finally given birth to its heavyweight, 16-bit second processor for the BBC Micro. Planned originally as part of the BBC Computer Literacy Project, the product which has emerged far outstrips the original concept. It is now considered to be too powerful for the needs of the education market, and has been transferred to Acorn's Scientific Division, which services the universities and other advanced academic and industrial users. During the metamorphosis, it has been renamed the Cambridge Co-Processor to emphasise its relationship to the Cambridge Workstation, which was launched at the same time.

Physically, the Cambridge 32016 Co-Processor resembles the other Acorn second processors and 1MHz bus accessories, with a half-width case and an umbilical ribbon cable to connect it to the host computer. Internally, the arrangement is the same as that of the 6502 and Z-80 second processors, with a separate power supply and a single PCB occupying the whole of the available space in the case. This PCB carries the parasite processor and has two rows of RAM chip holders down one complete side. Either 64K or 256K chips can be fitted, but all production models use the larger chips. The current version of the software requires a minimum of 512K of RAM, so only 512K and 1Mbyte versions are to be sold.

The 32016 processor is clocked at 6MHz, compared with 8MHz on the Cambridge Workstation. Tube interfacing is handled in customary Acorn fashion by a Ferranti ULA chip, but the operating system is much more complex than the eight-bit little brothers', occupying two 27128 EPROMs. At the other end of the Tube, a sideways DNFS ROM provides the communications routines. A 32081 floating-point unit handles all floating-point calculations, except for those running in BBC Basic. There is a large gap adjacent to the processor to house a 32082 memory management unit, should the Co-Processor be upgraded to provide virtual-memory facilities or to run a multi-user operating system such as Unix.

WHAT'S IN A NAME?

National Semiconductor's chip which powers the Co-Processor started life as the 16032, but became the 32016 when the marketing folk decided there was some mileage in emphasising the fact that it had 32-bit registers and many other attributes of a 32-bit microprocessor. Nevertheless, the external data bus, which is the main criterion for classifying a processor, is 16-bit.

The chip is housed in a 48-pin dual in-line package with a multiplexed 24-bit address bus and 16-bit data bus, permitting a direct address space of 16Mbyte. Internally, there are eight 32-bit general registers, and six 24-bit and two 16-bit dedicated registers.

The 32016 has over 100 basic instructions and nine address modes. It can add, subtract, multiply, divide, set bits, reset, test, transfer data, string, processor control, perform Boolean logic, array and block move and compare. Most operations can be performed on bytes, words and double words, while some can only be performed on bits and others on quadruple words. The instruction set is symmetrical, which means that all of the two-operand instructions can be used in all addressing modes. It

SPECIFICATION

CPU: National Semiconductor 32016 running at 6MHz
RAM: 512K or 1Mbyte
Operating system: Panos 1.1
Software in price: Fortran 77, C, BBC Basic, ISO Pascal, Lisp, Assembler
Manufacturer: Acorn Computers, Fulbourne Road, Cambridge CB1 4JN. Telephone: (0223) 245200
Price: £1,399 plus VAT for 512K; £1,699 for 1Mbyte
Availability: pre-production units available now; volume shipment from October

BASIC BENCHMARKS

The standard Benchmark routines — see *Practical Computing*, January 1984, page 104 — were run on the following units:

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Cambridge 32016 Co-Processor	0.43	2.32	4.14	4.82	5.96	9.80	15.07	12.51	6.88
Acorn Z-80 Second Processor	0.49	2.27	7.49	8.10	9.62	13.38	19.20	22.81	10.42
Acorn 6502 Second Processor	0.42	2.10	5.49	5.98	6.96	10.30	15.54	35.57	10.27
BBC Micro model B	0.65	3.17	8.20	8.93	10.42	15.41	23.27	52.56	15.53

can also perform memory-to-memory operations. One useful feature is top-of-stack addressing, which provides an extremely economical and speedy mode of operation.

Acorn has not adopted a standard operating system for the 32016 Co-Processor but has commissioned its own, called Panos, which was written in Modula-2. Panos offers the ability to amend, reconfigure or supplement parts of the operating system without a total rewrite, and is economical of systems resources. This last factor is particularly important when running mainframe software. Panos will support cross-language calls for Fortran, C and Pascal, which means that program suites written in any of these languages are available to applications writers working in different high-level languages.

Those familiar with the BBC Micro operating system will recognise many features of Panos, which supports program loading and execution, a procedural model of program execution, command-line interpretation, command files with parameter substitution, event handling, cross-language calls, a stream-based I/O model, support for Acorn ADFS, NFS and DFS filing systems, time stamping on files and file name extensions.

Cambridge Lisp has been developed to provide support for an ongoing research project in computer algebra. The impetus to write it came from a growing dissatisfaction with the Stanford system available on the 370/165. The 32016 implementation, intended for running experimental programs, makes a policy of checking for exceptional cases and provides clear and concise diagnostics.

ALGEBRA SYSTEMS

The expectation that the system would be used for writing parts of algebra systems has led to the inclusion of an arithmetic package that puts consistency above efficiency. Integers can grow to be any size, the normal arithmetic primitives know about rational numbers, and there is a well-defined interface between exact and floating-point number representations. The system provides a number of character-handling facilities, can select and use several input/output streams and has a built-in Lisp prettyprinter.

The Cambridge Lisp is largely compatible with the Lisp standard proposed by Professor A C Hearn of the University of Utah. The main limitations are a less efficient use of memory resulting from large parts of the system being coded in BCPL rather than machine code, and lack of support for functional closures or environments.

Acorn ISO Pascal is a compiled language comprising a two-pass compiler to translate Pascal source programs into 32016 machine code, and a library of pre-compiled modules to provide facilities such as string to numeric conversion. The Pascal compiler has been formally validated and conforms to BS6192 Level 1 Category A.

C IMPLEMENTATION

The Acorn implementation of C is a compiled language which conforms closely to the 1978 definition of Kernighan and Ritchie. It includes a C compiler, several standard C Include source files and a C run-time library. Source programs are prepared using the standard Acorn text editor, and machine-code modules are combined into a runnable program using the Acorn linker.

The BBC Basic provided for the 32016 closely follows the versions supplied with the other Acorn second processors, even to the extent that floating-point routines do not use the 32081 floating-point unit, but follows algorithms built into the interpreter. Basic IV, as the 32016 version is known, provides a classic illustration of the propensity for operating systems to fill available memory. The succint error messages of Basics I and II and HiBasic have been translated into extensive literary works. For example, "Division by zero" has been replaced by "Righthand operand of /, DIV or MOD should not be zero" whilst "– ve root" is now "Operand of SQR must be non-negative".

There are a number of extensions and additions to immediate commands, but, in general, BBC Basic programs will not need to be changed. The major differences are the lack of a built-in assembler and the handling of arrays in functions and procedures. The Basic Benchmark tests clearly indicate where the power of the 32016 processor comes into its own.

The 32000 Assembler runs in the Panos environment and supports the complete 32016 instruction set, including the 32081 floating-point and 32082 memory-management units. It handles all nine general addressing modes and can generate two types of object file: a simple binary image for immediate execution and an image in Acorn Object Module format. A source line may contain mnemonics, ASM assembly-language directives, comments or may be left blank for visual formatting. ASM accepts the full range of National Semiconductor assembly-language mnemonics and has the ability to define macros. Object code may be absolute or relocatable.

DOCUMENTATION

Documentation for the system is made up of eight separate volumes. Six reference manuals cover the 32000 Acorn Assembler and the high-level languages BBC Basic, C, Fortran 77, Cambridge Lisp and ISO Pascal. The Cambridge 32016 Co-Processor User Guide introduces the Panos operating system, while the Panos Programmer's Reference Manual is designed for the more experienced programmer. We saw only provisional versions of the documentation; it is being substantially revised for shipment with production machines.

A wide range of software has already been ported from mainframe and supermini implementations. Priority has been given to generic packages like spreadsheets, word processors and database managers, and software tools like mathematics and graphics libraries. There is a full NAG Fortran library with a number of statistical packages. The algebra system Reduce, written in Lisp, is an example of a product relying on artificial intelligence techniques. For the integrated-circuit designer there is Spice, a circuit-simulation program, while in the field of software engineering there are additional languages such as BCPL and Alogol 68C and graphics libraries including Gino-F, Grape-2D and Grape-3D.

Econet and RS-423 facilities are built-in, and there is an emulator to permit the microcomptuer to act as terminal for mini-computers or mainframes.

32016 CO-PROCESSOR

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	☐	■
Ease of use	☐	☐	■	☐
Documentation	☐	☐	■	☐
Value for money	☐	☐	☐	■

The facility to run mainframe software at a micro price — can't be bad.

CONCLUSIONS

■ The 32016 Co-Processor provides a tool which will give specialist micro users access to mainframe software.

■ Acorn appears to have abandoned its original concept of providing a 16-bit upgrade path for the BBC Micro. There is little in the 32016 Co-Processor for the average micro punter at this stage.

■ This solution represents a very cheap route to mainframe computing. Particularly cost-conscious users may well be buying the 512K version and plugging in the extra chips themselves to expand the memory capacity to 1Mbyte. PC

SAMNA WORD III
WP FOR BUSINESS

By Susan Curran

One of the most complete word processors yet from the Samna stable, this powerful package with its excellent mail-merging facilities could prove ideal for many office environments.

Samna Corporation is best known for its series of IBM PC word processors. Samna Word III is the most complete of the bunch, with considerable maths features, sophisticated mail-merging, and extensive support for alternative keyboards.

The program works on the IBM PC and most compatibles, and will make use of colour if it is available. It requires at least 256K of RAM, and can use more. Its price is broadly in line with other full-feature IBM word processors: around £485.

Samna Word is a protected program, and it can only be installed twice on to floppies or hard disc. One point to note is that only a single printer can be installed at once. In order to change the printer specification, the manual suggests that it is necessary to reinstall the program. In fact there is a printer change program on the printer disc which does the job with less fuss. However, even this makes life very difficult for those who alternately use draft and letter-quality printers.

The printer support is very specific. I found it impossible, for example, to use the program installed for an Epson with an alternative daisywheel printer. A fair range of printers are supported, but there is no provision for defining your own in detail if you possess a printer that is not fully supported.

Though I installed the main program successfully, I failed to find a way into the tutorial documents. As they are not fully documented in the manual, which does not have any kind of training section, I can give no indication of their usefulness.

Individual tastes for program features vary greatly, and it is doubtless my misfortune that Samna's particular style grates with me. The program has a tendency to heavy-handedness both on-screen and in its manual. For instance, there is an index all in capital letters, and capitalised prompts on-screen, including an infuriating READY! when nothing else needs to be displayed. The margins are coloured in stripy green, though mercifully it is possible to dispense with this, and page breaks and rulers are thick and unmistakable.

It is also possible to generate a screen full of dots, which the program suggests may prove a help in counting columns. There are dots for every possible character position, not just for those filled by spaces. Even when the dots are discarded, tab indents are marked by rows of dots. The overall impression is busy, to put it politely.

Samna begins with an elaborate date configuration sequence, used only in labelling files, since there is no Print Date feature in the program. It then comes up with a scratchpad screen. This is like a normal typing screen, except that only documents less than 50 lines long can be produced. In order to type beyond this limit, it is necessary to Save and Display a named file — a curious choice of default.

CONFUSION

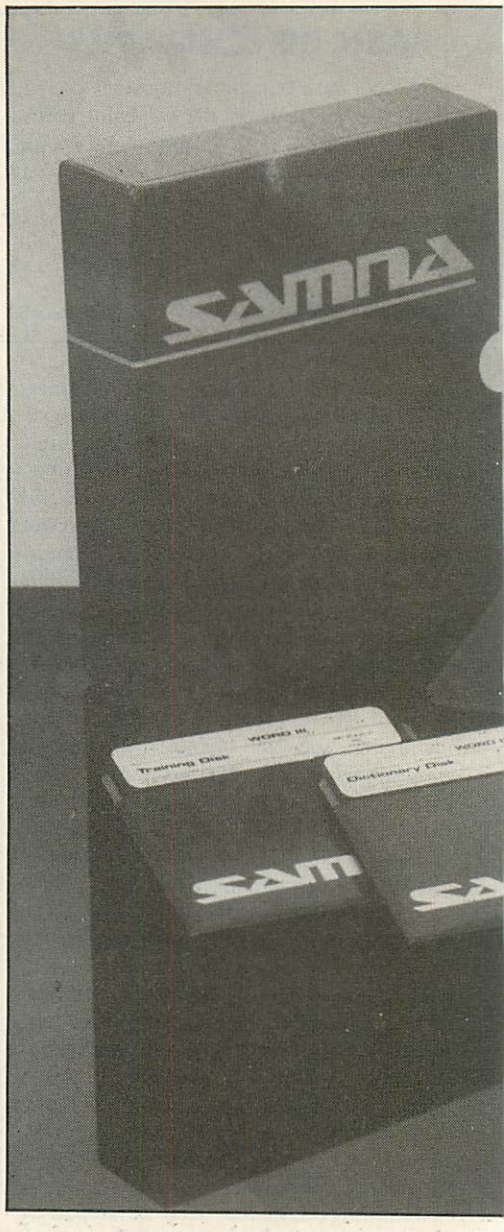
I also found the combined Save and Display command a difficult one to deal with. One implication is that it is quite impossible to exit from Samna without saving every document, except short documents generated on the scratchpad. Longer one-off letters and other disposable documents must then be deleted from the disc individually. Documents that have been revised are automatically saved under the previous name, so that the previous version is overwritten — though the program will keep a backup if required. This is maddening for any writer who occasionally wishes to discard unsuccessful revisions. Documents once saved are wiped from the screen, which is also annoying for those who like to make regular security saves during a long editing session.

SAMNA WORD III

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	■	☐
Documentation	☐	■	☐	☐
Value for money	☐	■	☐	☐

☐ Try it out. If you like it on first impression, it could be the ideal program for you.

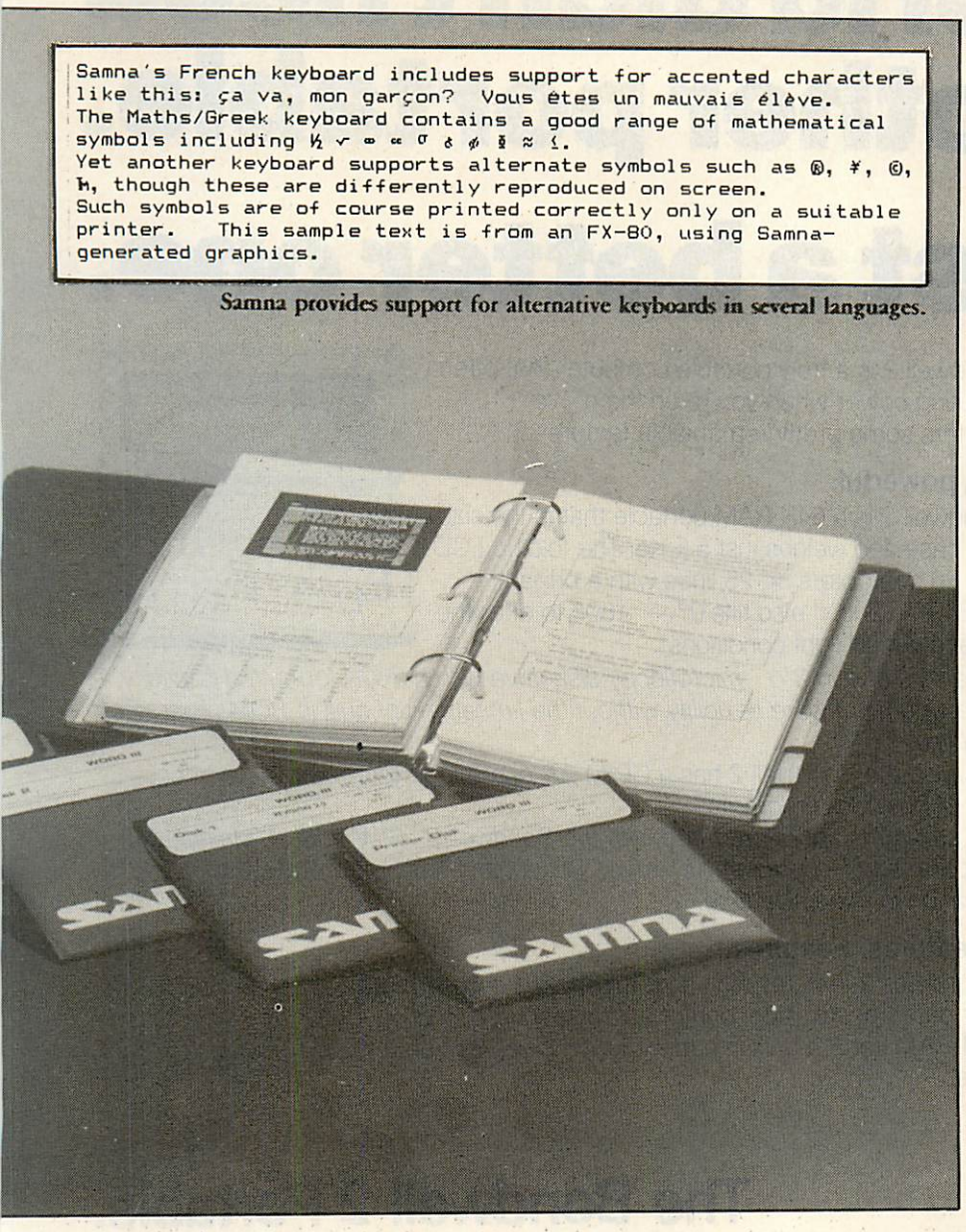


The program works in a fixed Overtype mode, and many commands which retrieve text will also overtype the screen contents. There is no full Insert mode as an alternative. Insert is a specific command, which produces a space on screen that is filled in when the insert is completed. The cursor keys are not operational in Insert mode.

Most commands are handled by the function keys: one to a key, with two multi-purpose Do and Select commands that also require letter mnemonics. Samna provides little plastic key stick-ons instead of a card template. It is also necessary to stick legends on the cursor keys such as "word" and "prgrph." However, this messes up the keyboard when you are using other programs, and several of my stickies peeled off before I finished reviewing the program. Life could be difficult for an occasional user who has not memorised which keys are for which commands.

Cursor movement generally works on a grammatical word/sentence basis. I missed a command that would take me quickly and directly to the start or end of a line, but overall there is a good selection.

Text is automatically reformatted on-



Samna provides support for alternative keyboards in several languages.

screen following insertions or deletions, and this works at moderate pace. Repagination is not automatic on-screen, though it can be done automatically on printing. Changes of format such as margin or justification changes must be ordered by shading the text to be reformatted, and here the program is slow in operation. Reformatting occasionally left spaces at the start of lines.

One excellent feature is the split-screen capability, which can be used to review two documents, two different parts of the same document, and for special features such as creating headers and footers or mail-merging.

PRINT OPTIONS

It is possible to print from screen or from a file. Among the on-screen print options is a block print which includes an automatic indent, which is very handy for putting addresses on envelopes. Not among them, curiously, is a Print Whole Document command. In order to print the document you are editing in its entirety, it is necessary to save it, then order a print, typing its name in full over again. Documents for printing can be queued up to five deep, and mail-merging as well as conventional printing is done in Background mode.

Samna Word stretches to a large number of commands, including most of the usual word-processor features and many useful extras. Among these are the generation of footnotes, indexes and tables of contents, columnar moves, multi-column newspaper-style printing, and folding of wide columnar text. The Maths mode is very sophisticated, providing three different registers for calculation. It will handle not only addition and subtraction but multiplication, division and percentages.

Mail-merging deserves a particular mention, both because it is unusually easy to use, and because it has more power than is normal. Unlike many programs, which simply save lists of data divided into unnamed fields and records, Samna enables you to name individual fields. It is possible to lay out a simple data-entry form on-screen and the user is then prompted through the completion of each record in turn. The field names are also displayed using the split screen when the outline letter is being typed or edited, which is extremely handy.

The record file is not a conventional text file, and it cannot be edited as one, but simple editing commands are provided. It is possible — though tricky — to select individual records from the file for merging. It is also possible to sort the entire record file on any field before merging.

A Find command is provided, though this works on the first field only, and it stretches to partial searches. Finally, it is possible to advance the record file and pluck information from other records during the merge operation. This adds up to a very powerful feature, which will make Samna a very good choice for offices in which there is a lot of moderate-scale mail-merging to be done.

BOILERPLATING

Named glossary files of standard paragraphs can be set up for boilerplating applications. There is also a quick access macro feature, enabling you to assign up to 10 phrases or key sequences for access with the numeric keys and Control.

The alternative keyboards provided are for English, French, Canadian bi-ligual, Spanish, Maths/Greek, German, Italian, and Swiss French. There is proper dead key support for accents, and the appropriate characters are displayed on-screen and, where possible, on supported printers. On a personal computer with a graphics board, Samna will do a zoom to give a miniaturised view of an entire page of type at a time.

The speller is based on Webster's dictionary, and is thorough, though it was not anglicised in my version. It allows the user to edit words in context, and proffers a set of alternatives for misspelled words. A feature I found annoying was the lack of an option to ignore a word, such as a proper name, throughout a document being proof-read without actually adding it to the dictionary. There is no word-count feature.

SPECIFICATION

Description: word processor with mailmerge and spelling checker
Hardware required: IBM PC or PC/XT, DEC Rainbow
Price: £469.50 plus VAT
Publisher: Samna Corporation of Atlanta, Georgia
U.K. distributor: Softsel Computer Products Ltd. Telephone: 01-568 8866
Availability: now

CONCLUSIONS

- Samna Word III is a very full-featured word processor, which proved to be extremely reliable in use.
- The program is disastrously ill-adapted for use by creative writers who require lengthy block moves and may wish to discard unsuccessful edits.
- The good formatting facilities, alternative keyboard, maths and other special layout features make it a useful program for an office environment.
- It is very difficult to use more than one model of printer with the program, which will be a hazard for some users.
- The mail-merging is outstanding, and this alone will sell the program to many offices. PC

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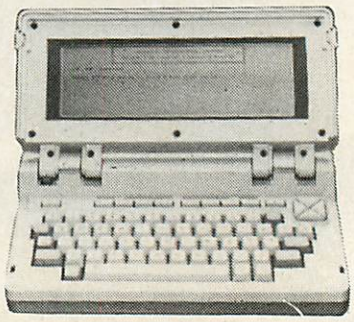

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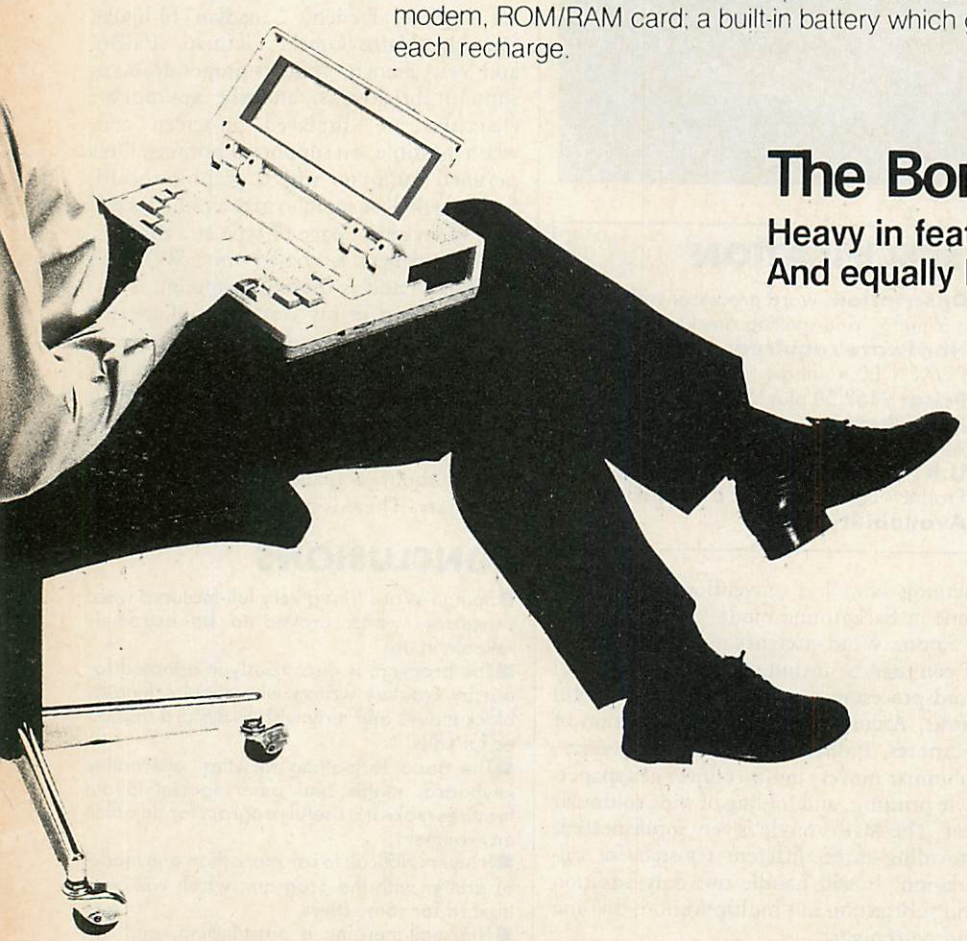

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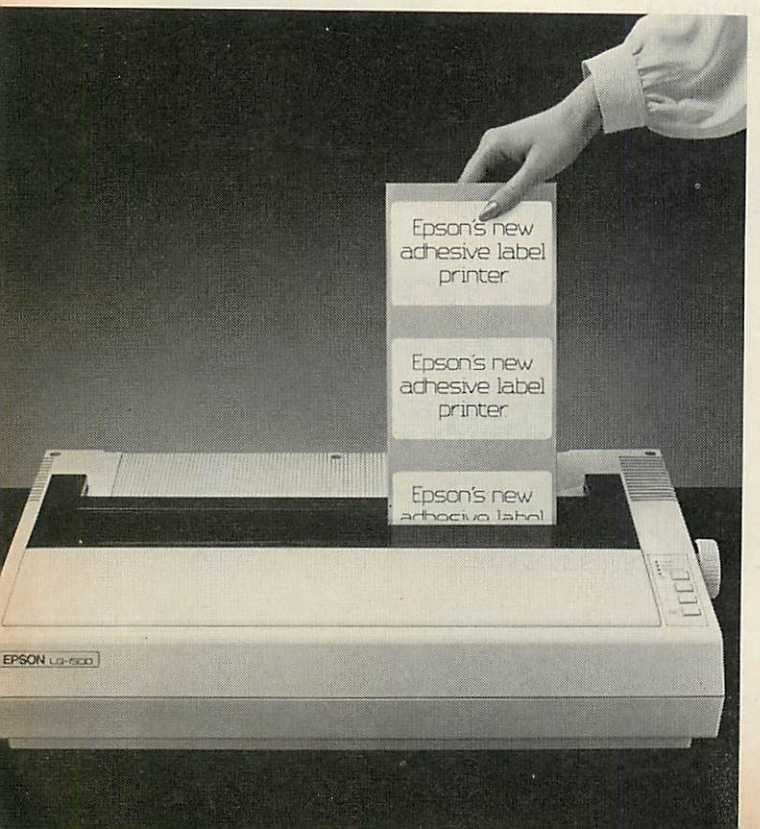

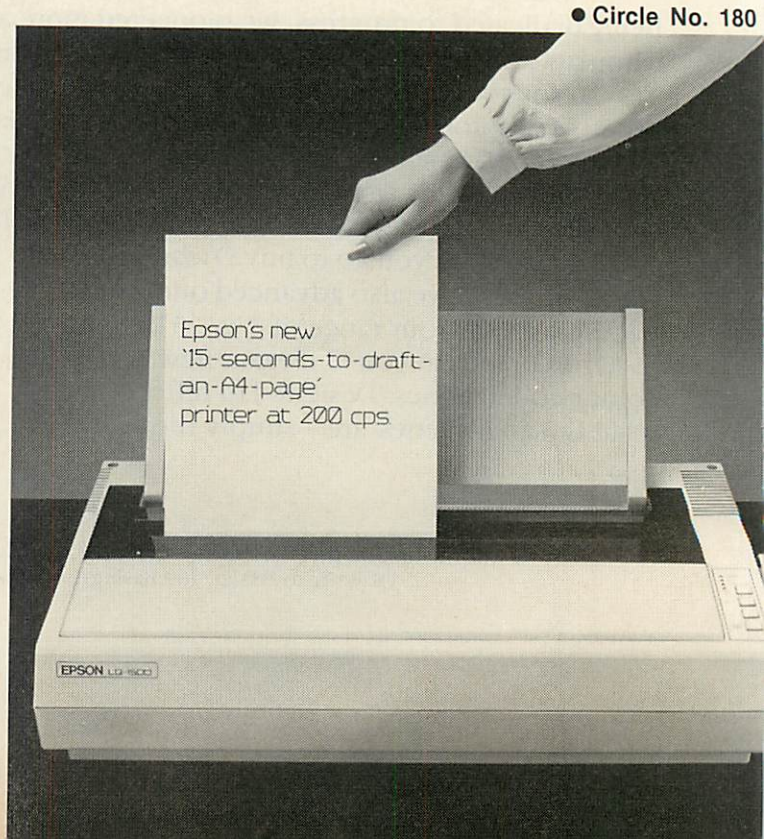

THE LAST ONE PLUS PROGRAM GENERATOR

By Chris Naylor

The Last One was the first of the programs that write programs. Now it has been updated.

Way back in 1980 a computer program was written which really gave the press a field day. It was The Last One and was so named, claimed the adverts, because with it you'd never need to write another program again. With a name like that the scope for adverse comment was enormous. Whichever way you looked at it, how could any program be the last program you'd ever need?

But beneath the hype on the one hand, and the criticism on the other, lay quite a product — for TLO was one of the very first program generators to hit the market in the micro field. Nowadays, these generators are often called 4GLs (fourth-generation languages); perhaps this imbues them with a little more respectability, but basically all they are is programs that write programs.

As you move up the hierarchy from machine code to assembler to high-level languages to program generators, the languages become easier to use, and each language in the hierarchy depends on the languages below it to produce executable code. In the case of TLO the output is Basic code, which is then run via the Basic interpreter until it ends up as executable machine code.

The other side of the coin is that as you move up the hierarchy the application width of the language narrows. In machine code you can do everything of which the machine is capable, but as you move to ever higher-level languages you become constrained as to what you can do. These constraints are a direct by-product of producing a language which is easy to program.

SPECIFICATION

Description: program generator for commercial users which produces programs in Basic from a menu-driven sequence
Hardware required: PC-DOS machines with Basic/Basica; MS-DOS machines with Basic 86 or MSBasic, or CP/M-80 with MBasic 5.2+
Publisher: DJ AI Systems Ltd, Summer Orchard, Speke Close, Station Road, Ilminster, Somerset TA19 9BJ. Telephone: (04605) 4117
Price: £375 plus VAT for PC-DOS/MS-DOS; £250 plus VAT for CP/M-80

```
                    addresse FLOWCHART CREATION
List.........................<1>  Clear.........................<11>
Modify.......................<2>  Set pointers.................<12>
Code program.................<3>  File read....................<14>
Merge F/C....................<4>  File write...................<15>
Abort........................<5>  Search/Sort..................<16>
Keyb'd input.................<6>  Merge........................<17>
Display data.................<7>  Record check................<18>
Branches.....................<8>  Delete file..................<19>
Calculations.................<9>  Database Functions...........<20>
Sp.Functions................<10>  Multi-functions.............<21>
```

Creating a program simply consists of choosing options from the flowchart creation menu.

```
1 .. Branch on a 3 option menu
2 .. Insert data into address.dat file
3 .. Amend address.dat file
```

Figure 1.

Most microcomputer program generators are constrained to work in commercial applications, primarily building up databases and developing programs to access them, and TLO is no exception. But for developing more mundane applications it has scored exceptionally high.

If you are writing a program in Cobol, a very highly structured language, it will not usually work if you happen to leave anything vital out. Compare this to Basic, which is a very loosely structured language in which you will almost certainly leave something out somewhere before you get it working right. What TLO does is impose the structure and discipline normally associated with a Cobol program, and produces a Basic program as its output. It is very much like a menu-driven method of writing Cobol programs in Basic. You just start TLO running, and it guides you through a series of menus and prompts at the end of which you get a Basic program.

From the time you start using it, TLO keeps a record of everything you have ever done, every file you have created, every screen format you have designed, every program you have written and every disc you have used. It keeps this record on disc and can print it out on the printer — which all adds up to a comprehensive set of documentation aids for lazy programming. So when, for instance, you decide to write a new progam TLO will ask you if you have any files in the program and, if you do, it will be able to show you what files you have already defined — which could save you having to redefine the same file twice, in many cases. The same applies to screen designs, report forms, and the like.

The new version of TLO, called The Last One Plus, contains an extra set of menu options to carry out database functions much more simply. As an example I ran up an address-book program to test these functions and found that the basic program could be defined with no more than three choices from the TLO menus, giving the basic flowchart, as shown in figure 1. After that you just follow the screen prompts and a ton of executable Basic code drops out at the other end of the process. Running this new version of TLO Plus on the IBM PC/XT couldn't have been easier. It helps, at times, to read the manual but even if you do something wrong you can always go back and modify the program you have written.

THE LAST ONE PLUS

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	□	□	■	□
Ease of use	□	■	□	□
Documentation	□	□	□	■
Value for money	□	□	□	■

□One of the very few program generators currently available which the commercial user should seriously consider buying.

CONCLUSIONS

■The Last One has a high level of integration and good documentation, providing a comprehensive environment in which you can develop programs.
■The time and effort required to master TLO pays off in the program's powerful features which do not run out of steam when your applications start getting complicated.
■The Last One Plus offers some worthwhile improvements in its ability to generate database functions. PC

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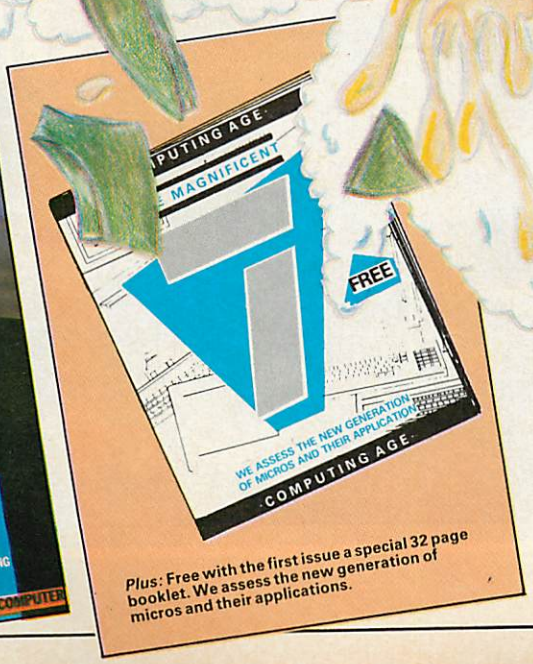

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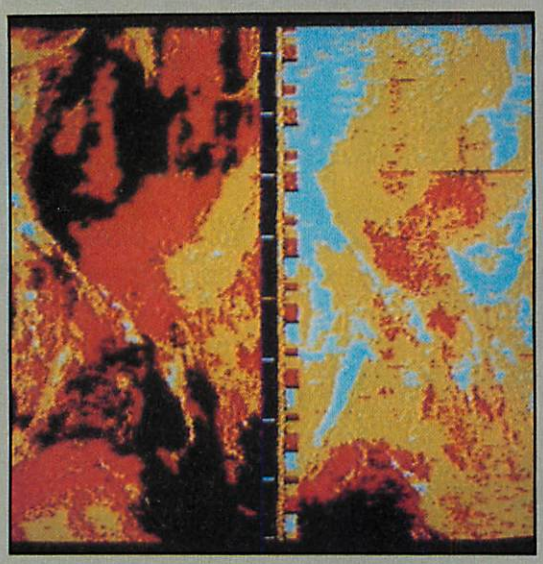
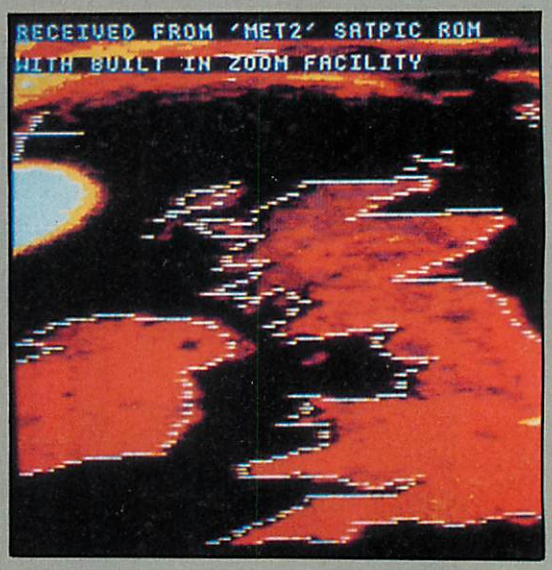
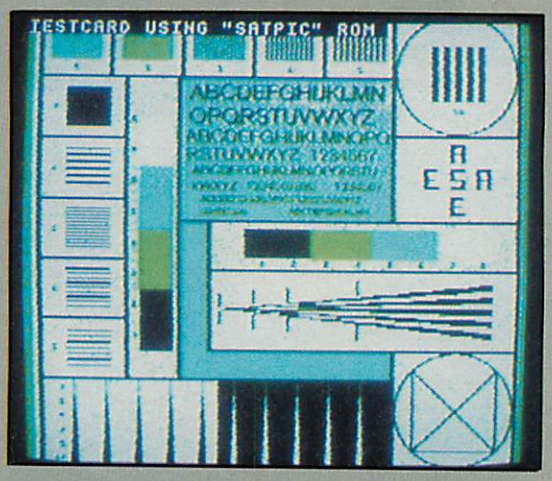
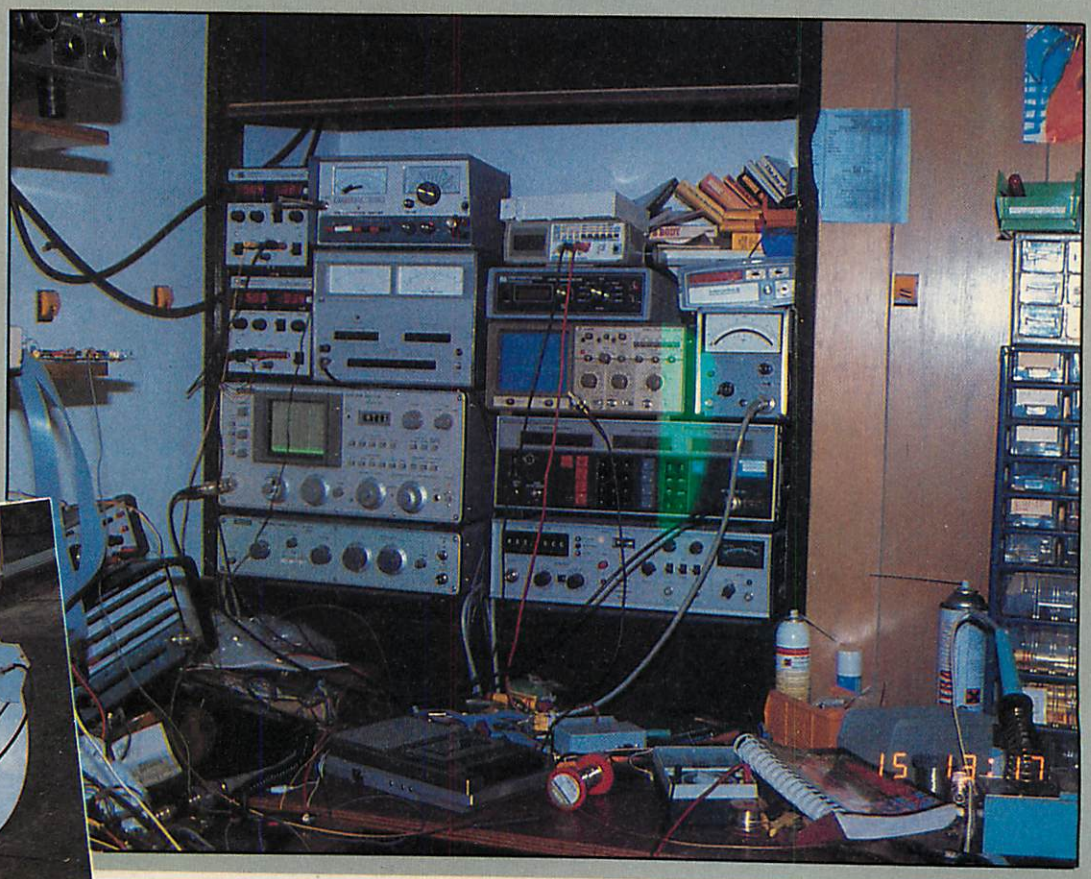


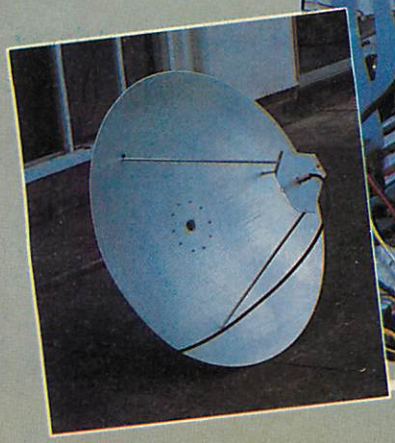


Right: The NOAA polar orbiting weather satellite transmits visible and infrared images side by side. Far right: A scan of the British Isles from the NOAA satellite.



Above left: A Timestep scanning receiver and interface unit. Above right: Meteosat's test card. Below: Timestep's dish aerial, which is required if you wish to pick up signals from geostationary satellites. Bel w right: Some of the equi ɔment used by Timestep in developing the satellite system.



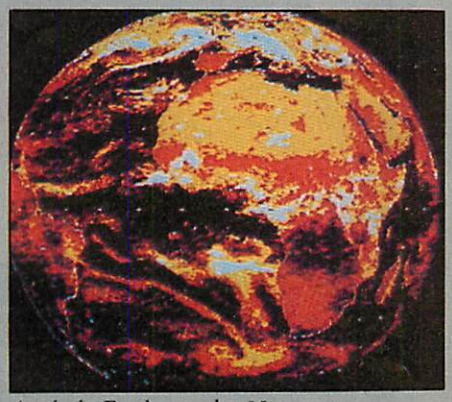


An affordable system that links to the BBC Micro to capture weather and TV surveillance information that is continuously being transmitted by orbiting satellites.

TIMESTEP SATELLITE SYSTEM

RECEIVING STATION

By Roger Cullis



A whole-Earth scan by Meteosat.

Bored with Basic? Weary with word processing? Then perhaps a little extra-terrestrial data processing might revive your jaded keyboard. To this end Timestep Electronics has launched a range of low-cost add-ons for the BBC Micro to bring satellite communications within reach of even the most limited budget. All you need, in addition to a receiver and interface unit with sideways ROM, is a simple outside aerial and you are, quite literally, out of this world.

The BBC Micro is well suited to the display of data received from weather satellites. The signal from the aerial is simply fed to a receiver and an interface unit. Timestep will supply these in kit form for under £80. However, unless you are an experienced hardware engineer, it is advisable to purchase the ready-made units which are ready to plug into the computer.

The receiver can be supplied with an optional scanner unit, which permits the reception of other satellites transmitting in the two-metre band. The interface is connected to the printer and user ports, and there is a sideways ROM containing the necessary software.

Display of weather satellite transmissions is simple. The sideways ROM is enabled with a *S. command which switches the computer to the satellite reception mode. Protocols for different satellite systems such as NOAA, Russian, 2Hz or 4Hz scan rate are selected by means of the function keys. The slow-scan TV image is in monochrome, but the interface displays different grey levels as different colours to provide better contrast. Colour combinations can be selected from a menu which is shown when the Escape key is pressed.

A satellite transmission creates a characteristic noise at the receiver and you very quickly learn to recognise it. When the signal is present, a line appears at the bottom of the screen

SPECIFICATION

Description: complete system for polar orbiting satellites comprises VHF aerial with optional preamplifier, receiver with optional scanner, interface unit and software on EPROM; dish aerial with down-converter required for geostationary satellite.

Manufacturer: Timestep Electronics Ltd, Wickhambrook, Newmarket, Suffolk CB8 8QA. Telephone: (0440) 820040.

Prices: VHF aerial £34.50; preamplifier kit £4.95, tested module £10.95; co-axial cable 20p per metre; receiver kit £37.50, tested module £48.50, boxed complete £79.95, crystal £4.60; interface unit kit £39.50, tested module £58.00, boxed complete £88.50; power lead £8.95; software (EPROM) £37.50; 136MHz to 138MHz kit £49.95, tested module £78.50; dish aerial with down-converter £325.

(continued on page 85)

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KINDS OF SATELLITES

Satellite communications were proposed in the famous article by Arthur C Clarke published in *Wireless World* for October 1945, and began in real earnest when the USSR launched Sputnik 1 in 1957. Since then the skies have been filled with all manner of orbiting devices which communicate with us, survey us and, if a trigger finger gets itchy, may eventually zap us all. Among the applications that are playing an increasingly important role is television surveillance, which is used for weather forecasting and earth resource management to help increase crop yields.

In order to maintain itself in a stable orbit, an object has to travel at such a speed that its centripetal force balances the gravitational attraction to the Earth. At close distances, this force is high and the orbital velocity is correspondingly large, but as the distance from the surface increases, lower velocities are necessary.

A satellite orbiting at a height of 35,800km will have an orbital period of 24 hours. If it is positioned above the equator, the satellite moves in exact synchronisation with the Earth's rotation and appears to remain in a constant position in the sky. This is known as a geosynchronous orbit. At all other distances, a satellite's position appears to change. If it is launched in an orbit about the poles, the orbits precess and the satellite is able to scan the entire surface of the globe, a segment at a time.

Weather satellites are either in geostationary orbit or else they are at a height of 80km to 900 km in an orbit which passes over the poles. The polar orbit of the current National Oceanic and Atmospheric Administration (NOAA) weather satellite takes about 102 minutes, and each scan is displaced from the previous one by about 25°.

There are five parking positions for geostationary satellites, which are arranged to give full coverage of the globe. But as far as U.K. weather forecasting is concerned, the only ones of significance are Meteosat, which looks at Africa and Europe, and GOES-East, which orbits above the Americas and scans part of the Atlantic. Only one polar orbiter is necessary for a full Earthscan, although at present there are two NOAA satelites doing this. The current weather satellites do not have a television camera, but use a mirror radiometer to sense radiation from the earth's surface and atmosphere in order to construct a television picture. The radiometer is positioned radially on the satellite which spins on its axis, thus creating the line scan. Frame scan is provided by an oscillating mirror.

There are five sensors, of which two respond to visible light, two are infrared sensitive, and one responds to the water vapour absorption band. The raw data is transmitted to a ground station for processing into a format suitable for broadcast transmission. The pictures are edited by adding in continental outlines and other reference marks and then sent to the satellite's transponder for retransmission to ground stations.

The polar orbiting satellites are continually moving across the sky, so their transmissions have to be captured while they are within range of the aerial. They also scan a smaller area of the Earth's surface in each frame. On the other hand, the geostationary satellites view a large area of the globe. When processed, this information is retransmitted via two channels. The first, to so-called primary data users, includes a high-resolution image of the entire field of view with 64 grey levels. This definition is so high that the user can select his or her desired segment and zoom in on it. For secondary data users, the globe is divided into nine segments and the scans are transmitted in sequence in accordance with a schedule published by the European Space Operations Centre in Darmstadt.

As well as the images derived from its own sensors, Meteosat transmits test cards, an information bulletin and the scans from the American GOES-East, which are relayed to the satellite by way of a ground station at Lannion in France. These transmissions follow a preset timetable, so it is possible to determine which view is being transmitted according to the time of day, which is very helpful when there is a lot of cloud cover because it is frequently difficult to distinguish any recognisable features. Transmission of a complete frame to secondary data users takes about 4.5 minutes. NOAA polar orbiting satellites transmit a visible radiation and an IR view side by side.

A further difference between the polar-orbiting and geostationary satellites is the frequencies of their broadcast transmitters. The former transmit in the two-metre band at 137MHz, while the latter occupies a couple of channels in the S-band at about 1.6GHz. Fortunately, the transmission protocols are the same, so all that is needed to permit a common receiver to be used is a preamplifier attached to the microwave antenna and a down-converter at the end of the feeder cable.

A dish aerial is required for microwave reception, and Timestep supplies one complete with down-converter. For VHF reception, a standard two-metre aerial, such as the J-beam crossed dipole, will suffice if suitably mounted. The surprising thing is that it is not necessary to track the satellite as it passes overhead. The signal is sufficiently strong for it to be possible to capture several frames during each pass.

Weather satellite transmissions use an automatic picture transmission system (APT) which requires relatively simple receiving and processing equipment at the ground station. The signal from the receiver is at audio frequency with a 2.4kHz subcarrier, modulated with video information. Positive modulation is employed with a black level of 5 per cent and a peak white of 80 per cent. Sync pulses are provided for the start of each line and the start and finish of each frame. The scan rate is 120 lines per minute.

(continued from page 83)

TIMESTEP SATELLITE SYSTEM

PC VERDICT

	POOR	AVERAGE	GOOD	EXCELLENT
Performance	☐	☐	■	☐
Ease of use	☐	☐	☐	■
Documentation	☐	☐	■	☐
Value for money	☐	■	☐	☐

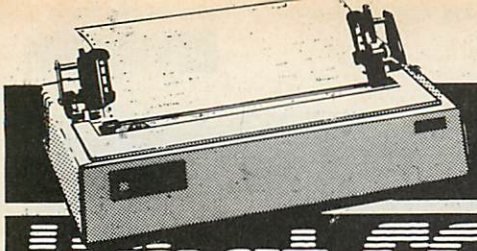
☐ For the computer owner who has everything, this kit will provide a talking-point at dinner parties.

and this builds up into a full frame. The signal level fed to the interface is adjusted to provide the desired contrast range on the display. The line-sync pulses will display as a continuous bar and the next step is to move these to the left of the screen by pressing the slip control on the interface unit. A preset resistor is provided to adjust the sensitivity of the slip control. If there is a variation in the brightness of the incoming signal, this may be adjusted by one of three black-level switches.

With polar orbiting satellites, you can reckon on six good passes a day, but these may not be at a convenient time for reception. For this reason, Timestep supplies an optional relay to control a cassette recorder, so that the picture may be played back at a convenient time. Geostationary satellites are transmitting continuously, so this equipment is not required for them. Instead, you need a more elaborate dish aerial. The transmission standards are the same, so once the signal has been converted to a frequency in the two-metre band it can be processed by the standard Timestep equipment.

CONCLUSIONS

- With kits, built and tested modules, and complete units, Timestep caters for all budgets.
- For educational use, this equipment will help to move the computer out of the computer studies department and into CAL. PC



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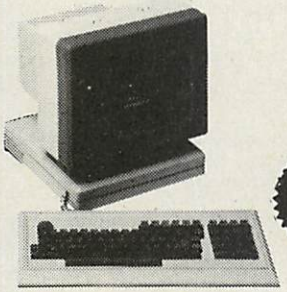

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INTERVIEW

ERIC HOWE — Data Protection Registrar

INTERVIEWED BY GLYN MOODY

After graduating in economics in 1954, Eric Howe joined the National Coal Board, working in a research capacity. He held a similar post at the British Cotton Industry Research Association before moving on to the English Electric Computer Company in 1961, where he rose to Northwest Area Manager. He then joined the National Computing Centre in 1966; he was Deputy Director when he left in 1984 to become the first Registrar appointed under the Data Protection Act. He and his staff are responsible for handling the registration of all data users, and any complaints arising out of the provisions of the Act. The registration process will begin on 11 November this year and must be completed before 11 May 1986. Details of the Act can be found in last month's *Practical Computing*.

How many registrations are you expecting?
WE originally worked on a Home Office estimate which was about 200,000 in the first six months, and probably of the order of 300,000 by the end of three years. We think it might be higher than that. We're now looking at what the shape of budgets will be if they're coming more at the 300,000 level, going up to 450,000 at the end of a three-year period.

As far as micro users are concerned, do you think that it may be a process of winkling them out?
I THINK that's probably true. We hope that we will get everybody registered by 11 May, and certainly they are in a position of potential jeopardy if they are not. In practice, I suspect that we'll still be finding micro users after that.

Do you not think one problem may be that the £30 registration fee is rather high for micro users?
WELL, it is for a three-year registration. One or two people have said "Can you not vary the fee according to the size of the organisation?" But if we did that the sheer administration problem of determining "should this man be a £10 fee or a £30 fee" would have pushed the fee up for everybody.

As far as registration goes, do you have to register each and every micro in a company?
NO. The Act doesn't say anything about individual pieces of equipment. It doesn't actually refer to applications other than in one or two of the exemptions. What you would register is the purpose for which you hold data. So, for example, supposing you are registering personnel as a purpose. If you were a huge company like ICI which had personnel systems on several hundred micros, then it could register once — for all those micros. What you will have to do is know where data is in the company, covered by that registration.

If a company has fallen foul of the law, who gets penalised?
THE DATA USER, in this case the company, would be responsible. But the responsibilities under the Act also lie on the servants or agents of that data user. So supposing in a large company, someone is running a small department with a micro. Then providing that the company has really set proper standards, and trained its people and set proper disciplines for the processing of personal data, if the person who's running that micro system does something knowingly and recklessly in contravention of those disciplines, and causes damage, it could be that we will issue a case against the employee rather than the company.

What will be the charge to the individual for requesting information from data users?
THAT'S A MATTER for the Home Office to decide. When the Act was progressing through Parliament, I think the figure £3 to £8 was mentioned. Now what the Home Secretary will ultimately decide, I don't know. He will set a maximum. People can waive the fee as they wish.

What level of demand for subject access do you expect?
EXPERIENCE in other countries tends to suggest that there'll be an initial surge, then it'll settle down and subject access isn't a significant probelm. But whether we're going to be different in the U.K. I don't know.

In granting subject access, won't there be a temptation to leave out information?
LET'S SUPPOSE someone is tempted to do that, and the person who gets it may have some reason for knowing that something has been left out because he has some other evidence it was there. He comes and complains to me and then I go to the data user and we could end up in a situation where I'm issuing an enforcement notice on the data user to enforce the provision that he should have met. If it gets serious enough I could perhaps be issuing a de-registration notice. And if I do that, he can't process data without committing an offence. And that's a very serious situation for organisations.

What overall effects do you think the Act is going to have on the way people compute in this country?
ONE IS that they will have a better public climate in which to do their computing, because I think that confidence in computing will increase. The public will feel that as far as their own personal information is concerned, it's being properly handled. The actual users themselves will benefit from the principles as well as the individuals, because most of the principles are sensible principles about collecting data fairly, not keeping it longer than relevant, making sure it's adequate, securing it properly.

How would you expect future legislation to extend the Data Protection Act?
I ALWAYS SAY I have no personal opinion on this Act because I can't possibly. In the fullness of time, as the Act develops, I may well put in a report to Parliament on the way the Act is working. But we've not reached that point yet. PC

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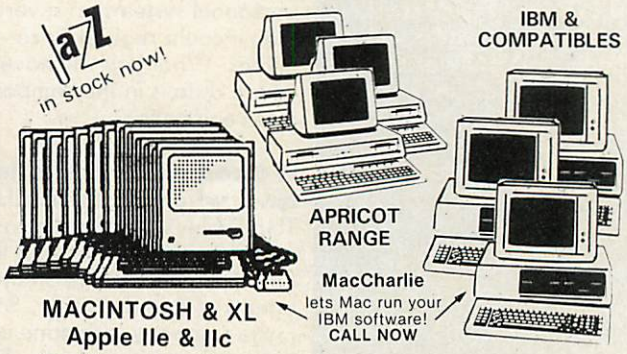

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A. Advanced telephone features, including directory with short-code dialling 5
B. Easy access to electronic mail services such as Telecom Gold ✓
C. Access to external information services, including Prestel ✓
D. Inter-One Per Desk messaging capability 6.
E. Communication with in-house computer systems 1
F. Personal computing facilities with spreadsheet, word processing, database and graphics. ✓

The winning entry will be the one that matches or comes closest to the order chosen by the judges. In the event of a tie, the tie-breaker will be used.

Rules

1. The competition is open to all readers of *Practical Computing* normally resident in the U.K., except for employees of Business Press International Ltd or International Computers Ltd, or their families.
2. Each entry must be written in ink on the official entry form printed here, or a photocopy. Only one entry per person is permitted.
3. Completed entry forms should be posted to the address shown on the entry form to arrive not later than 30 November 1985. Envelopes must be clearly marked "ICL Competition" in the top left-hand corner.
4. No correspondence can be entered into regarding the result of the competition and it is a condition of entry that the decision of the panel of judges is final.
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Using not more than 10 extra words complete the following phrase in the most apposite possible way:

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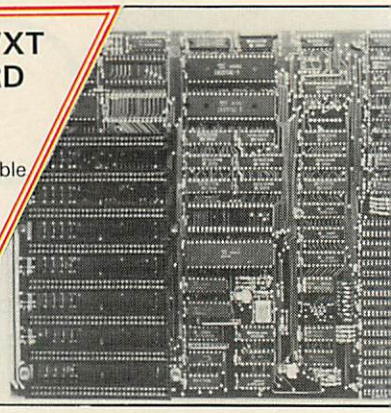

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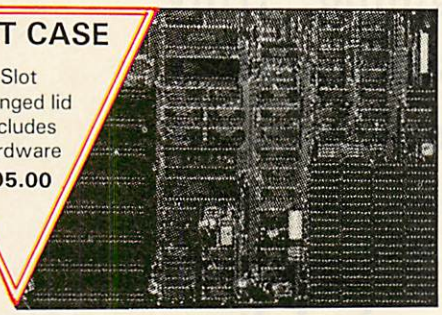

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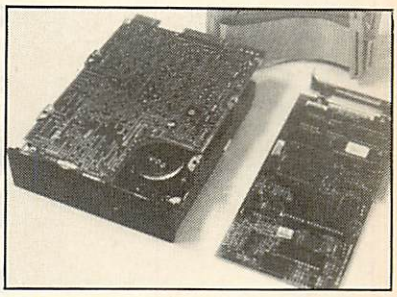

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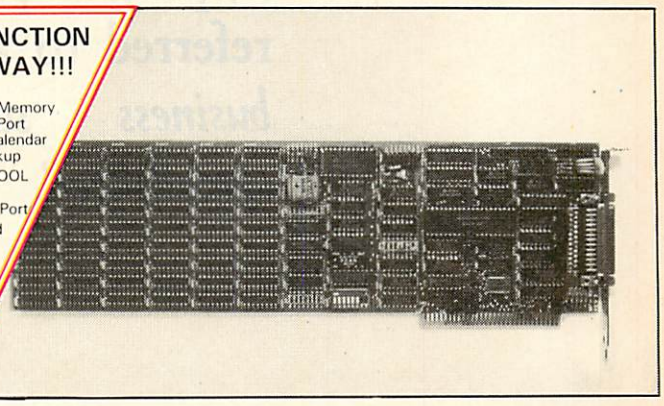

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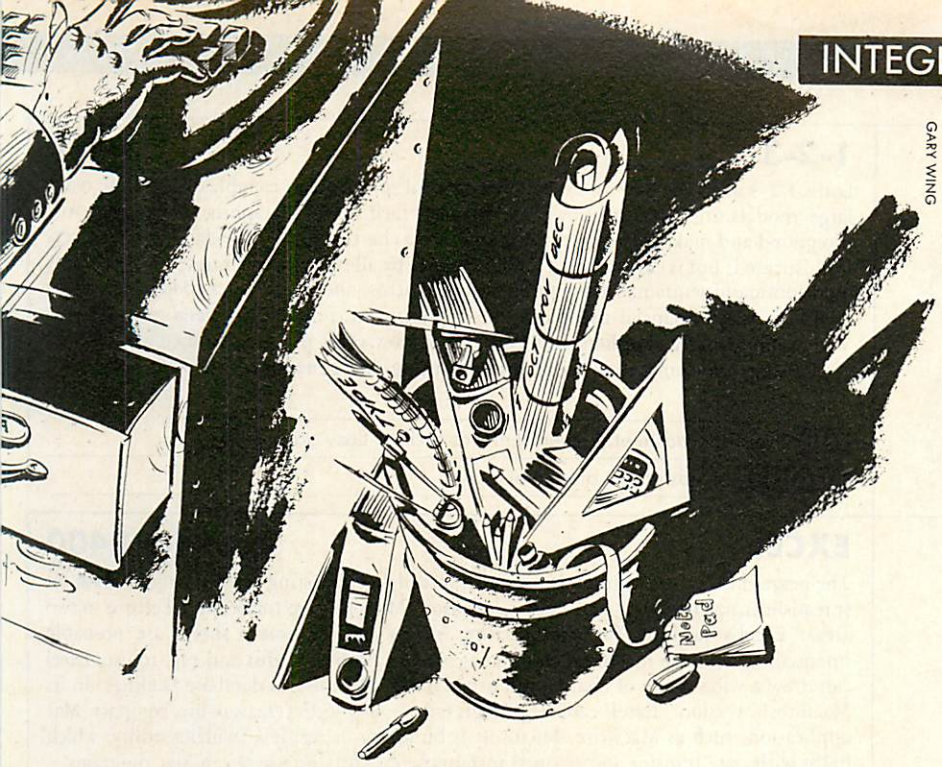

GARY WING

MASTER OR JACK?

For two years Lotus 1-2-3 has been at the top of the business software sales charts, so integrated software is clearly more than a fad. Ian Stobie assesses the contenders.

SUPPLIERS

1-2-3, Jazz, Symphony Lotus Development (U.K.) Ltd, Consort House, Victoria Street, Windsor, Berkshire SL4 1EX. Telephone: (0753) 840281. Circle no. 361.
Excel Microsoft Ltd, Piper House, Hatch Lane, Windsor, Berkshire SL4 3QL. Telephone: (0753) 559951. Circle no. 362.
Framework Ashton-Tate (U.K.) Ltd, 1 Bath Road, Maidenhead, Berkshire SL6 4UH. Telephone: (0628) 33123. Circle no. 363.
Logistix Grafox Ltd, 65 Banbury Road, Oxford OX2 6PE. Telephone: (0865) 516281. Circle no. 364.
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Supercalc 3 Sorcim-IUS Micro Software, 16-20 High Street, Maidenhead, Berkshire SL6 1QH. Telephone: (0628) 70911. Circle no. 368.

Integration sets out to bring two principal benefits: improved ability to move data between different applications, and greater ease of use. Moving, say, a table from a spreadsheet into a word-processed report is obviously easier to achieve if both applications are written from the outset with this in mind.

The second benefit, ease of use, flows from the greater opportunity the system designer has to develop a consistent style of interaction: if several applications are all developed at the same time they will hopefully end up with a more consistent command set.

Reduced cost to the user is another advantage often cited for integration; one multi-function integrated package can add up to less than a set of stand-alone applications for doing the same tasks. This point is only valid if you really want most of the tasks the integrated package offers, and if it performs them well.

Lotus 1-2-3 is relatively modest in the number of things it attempts to do. Basically it is a very good spreadsheet with good graphics and rather more limited database facilities. Immediately after the software world woke up to the success of 1-2-3, everybody seemed to be bringing out integrated software.

There are problems in going too far down this route on a micro. You rapidly start running out of memory, disc space and maybe even processing power. Apparent luxuries go out of the window, while the core functions start looking increasingly inferior to stand-alone applications. For example, one of the attractions of 1-2-3 is its excellent on-screen help. In contrast, Lotus's latest package, Jazz, offers five functions on the Macintosh but has no built-in help facility.

A further drawback is a likely increase in complexity for the user. The designer's goal of a simple, compact set of commands starts becoming harder to achieve as you pile on the number of applications. The user might end up preferring a more straightforward stand-alone package that is easy to master.

For all these reasons the high tide of massive integration has receded. The latest packages, like Reflex or Excel, tend to settle for no more than three or four applications.

An important alternative approach to the true integrated package is the data-integrated family of stand-alone applications, all usually from the same manufacturer. Here each program is loaded and run separately, but it can make use of data generated by other programs in the range. Examples are the Perfect, PFS, Smart, Easy, Practi- and -Star families.

What you lose is the convenience offered by the best integrated packages, which tend to encourage you to look at your data in different ways. On the other hand, you only have to buy a new application when you really need it, and some programs using the family approach carry out their single task in greater depth than an integrated package.

In the long term, the integrated package as we know it is likely to disappear, not because of competition from the present-day family approach but because of developments in operating systems. It makes much more sense for the operating system to take over most of the job of integration, rather than have application programmers continually rewriting interface and data-transfer software.

This change is already beginning to happen on the Macintosh. Here the machine itself establishes a highly recognisable style of interaction. This has been followed by most people developing for the Mac because the necessary routines are built into the machine in ROM; you would have to have a really strong reason to go the trouble of rewriting the interface from scratch. The Mac operating system also provides a number of mechanisms for transferring both text and graphic data between programs; again, the code for this is in ROM. As a result, most Mac programs work in roughly the same way, and it is generally possible to transfer data between them, although until recently the data transfer procedures were tedious.

Apple has now developed a new operating-system utility called Switcher for the larger-size Mac with 512K of memory. This lets two or three programs reside in memory at the same time, with instantaneous switching between them and far easier data transfer. It seems likely that Jazz will be one of the last all-encompassing packages for the Mac, as Switcher offers a more flexible approach.

In the IBM universe, for the time being Lotus-style integration at the application level will remain dominant. MS-DOS, designed in the days of expensive memory, is not capable of supporting the facilities offered by Switcher. But as memory sizes increase, the Switcher approach makes more sense, as it allows users to integrate virtually whatever packages they like. Any operating system supplanting MS-DOS in the future is likely to take much of the responsibility of integration away from the application developer. PC

RUNS ON: IBM, MS-DOS

DATABASE GRAPHICS SPREADSHEET

1-2-3 £430

Lotus 1-2-3 gives the user an extremely powerful spreadsheet, capable of handling really large models and offering powerful financial facilities. Its graphics features are well integrated and make it easy to turn figures into a chart or graph. The database is not very sophisticated, but is easy to use. 1-2-3 also scores by allowing the user to set up frequently used command sequences as single-keystroke macros, and by having a good on-line help facilities. Many financial users also like its ability to consolidate several spreadsheets. Various third-party suppliers and Lotus itself now offer pre-programmed spreadsheet applications and companion programs to do things like generate reports with 1-2-3 data.

FOR Great spreadsheet. Powerful macro facility. Easy graphics.

AGAINST Needs plenty of memory.

RUNS ON: Mac now, IBM next year

DATABASE GRAPHICS SPREADSHEET

EXCEL under £400

The heart of Excel is an extremely powerful spreadsheet boasting an even larger maximum spreadsheet size than 1-2-3 and fast calculation. Microsoft has made special efforts in two areas: Excel's facilities for consolidating sheets into summary sheets are probably unequalled, and the macro facility manages to be both powerful and easy to use. Excel can draw a wide range of charts, and offers limited but useful database facilities. In its Macintosh version, Excel can be integrated to any other reasonably compact Mac application, such as Macwrite. Microsoft is bundling in Apple's Switcher utility, which helps with data transfer and permits instantaneous switching between Mac programs.

FOR Truly great spreadsheet. Good presentation graphics. Switcher.

AGAINST Brand new.

RUNS ON: IBM

DATABASE GRAPHICS SPREADSHEET

WORD PROCESSING

FRAMEWORK £550

Ashton-Tate's Framework is based on a database-like concept. You work on windows full of data, called Frames, which can contain words, spreadsheets, databases or graphs. The frames themselves are organised in a powerful higher-level database. Framework is quite simple to use, and lets you do things like search through data, annotate it, draw graphs and write reports and letters. Framework is probably most appropriate for business users who want to do the same kind of active analysis that spreadsheets encourage, but whose data is not mainly numeric. The package has a built-in programming language called Fred with which more ambitious users can create complete applications for specific tasks. Framework lets you access existing dBase files.

FOR Fast. Thoroughly programmable. Good WP and data handling.

AGAINST Needs plenty of memory.

RUNS ON: Mac

DATABASE GRAPHICS SPREADSHEET

COMMS

WORD PROCESSING

JAZZ £495

Jazz is the most recent of the three Lotus programs in this top 10. Although it incorporates five functions, including word processing, it is more like 1-2-3 than Symphony. To get it to run on the Mac, Lotus had to abandon some less essential features, and the program benefits as a result. It is an agreeable package, with all the bits easy to use together, and powerful enough to be useful. The spreadsheet is very good by Mac standards. The word processor offers full control over Mac founts, and also lets you merge graphs or values from the spreadsheet or database into form letters. Problems with Jazz are that it hogs too much of the Mac's disc space — even with two drives you feel you could do with more — and the current release is not fully bug free.

FOR Good spreadsheet. Good mail-merging WP. Easy to use.

AGAINST Still has bugs. Uses too much disc space. Won't work with Switcher.

RUNS ON: IBM, MS-DOS

DATABASE GRAPHICS SPREADSHEET

TIME MANAGER

LOGISTIX £395

Logistix adds the time-management function to the usual trio found with super-spreadsheets like 1-2-3 and Excel, all of them tightly integrated around the spreadsheet. The timesheet lets you allocate resources to particular jobs over a specific period. Information from the timesheet or database can be used in the spreadsheet, or graphed or charted. The spreadsheet can handle up to 2,048 rows by 1,024 columns, and consolidate data from different models. Logistix also offers a good range of chart types, which can be displayed in colour and annotated in a variety of different founts. The database is fairly simple, with records limited to 64 fields. Logistix is probably particularly useful to professionals who charge by the hour.

FOR Good graphics. Useful time manager.

AGAINST Nothing much.

RUNS ON: IBM, MS-DOS

DATABASE GRAPHICS SPREADSHEET COMMS TIME MANAGER WORD PROCESSING

OPEN ACCESS £450

Based around the database, all six Open Access applications are of a high standard, including the usually neglected communications module. Open Access really scores in its intelligent use of discs: workspace is automatically paged between the computer's memory and disc, so you are limited only by the available disc space rather than by RAM. Open Access's database is relational, meaning you can join two or more files by specifying common key fields. The spreadsheet is good and the graphics are superb, with a large number of different options, including three-dimensional charts. Open Access is an excellent package if you have large quantities of data to deal with. It makes the most of a hard disc if you have one, while running on modest 256K floppy-based systems as well.

FOR Excellent graphics. Good use of discs. Networking available.

AGAINST Unavoidably complex.

RUNS ON: IBM

DATABASE GRAPHICS STATISTICS

REFLEX £423

On the surface Reflex is just another database program, with graphics and statistics functions thrown in, and with a separate matching report writer. What makes it different is that the three core functions are very tightly integrated, and it is heavily optimised for the task of actively analysing data. You start by creating a data-entry form; Reflex then automatically creates a spreadsheet-like list as you enter your data. Pull-down menus help you manipulate the information, and let you open up windows containing graphs, summaries and cross tabulations of data. Reflex can read data from most other IBM programs, including dBase and 1-2-3, and send data to most word processors and spreadsheets.

FOR Optimised for analysing data. Functions well integrated.

AGAINST Brand new. Needs plenty of RAM.

RUNS ON: IBM, MS-DOS

DATABASE SPREADSHEET WORD PROCESSING

SILICON OFFICE £790

Although the credit is usually assigned elsewhere, Bristol Software Factory has a strong claim to having invented the integrated package with Silicon Office, running on the Commodore Pet. Based around a closely coupled database and word processor, the main product is now a totally rewritten 16-bit Silicon Office. The program divides up memory into separate areas for text, data, calculations and programs. It has its own command language, and you can set up programs to do things like sort through files, extract fields and merge them into letters and reports. You usually also have enough space for a small spreadsheet model. Silicon Office is well suited for routine business administration. A cut-down version for the Apricot F1 sells at £295.

FOR Good WP/database combination.

AGAINST Price. Getting long in tooth.

RUNS ON: IBM, MS-DOS, Apple II

DATABASE GRAPHICS SPREADSHEET

SUPERCALC 3 £295

Compared with most other integrated packages in this survey, Supercalc does not do very much apart from the spreadsheet, which is very powerful. It can produce a reasonably good range of different graph types, and has a rather limited database facility best suited to producing things like price lists and indexes. Supercalc scores by being very fast: the spreadsheet recalculates quickly and you can whip up a graph in seconds. The commands are also quick once you are used to them. Supercalc displays its graphs in colour or on a mono screen. Lists and tables derived from Supercalc can be inserted in documents produced with Sorcim's Superwriter and Easywriter.

FOR Fast. Can do graphics on IBM's mono screen.

AGAINST Takes a while to learn commands. Spreadsheet size a little limited.

RUNS ON: IBM

DATABASE GRAPHICS SPREADSHEET COMMS WORD PROCESSING

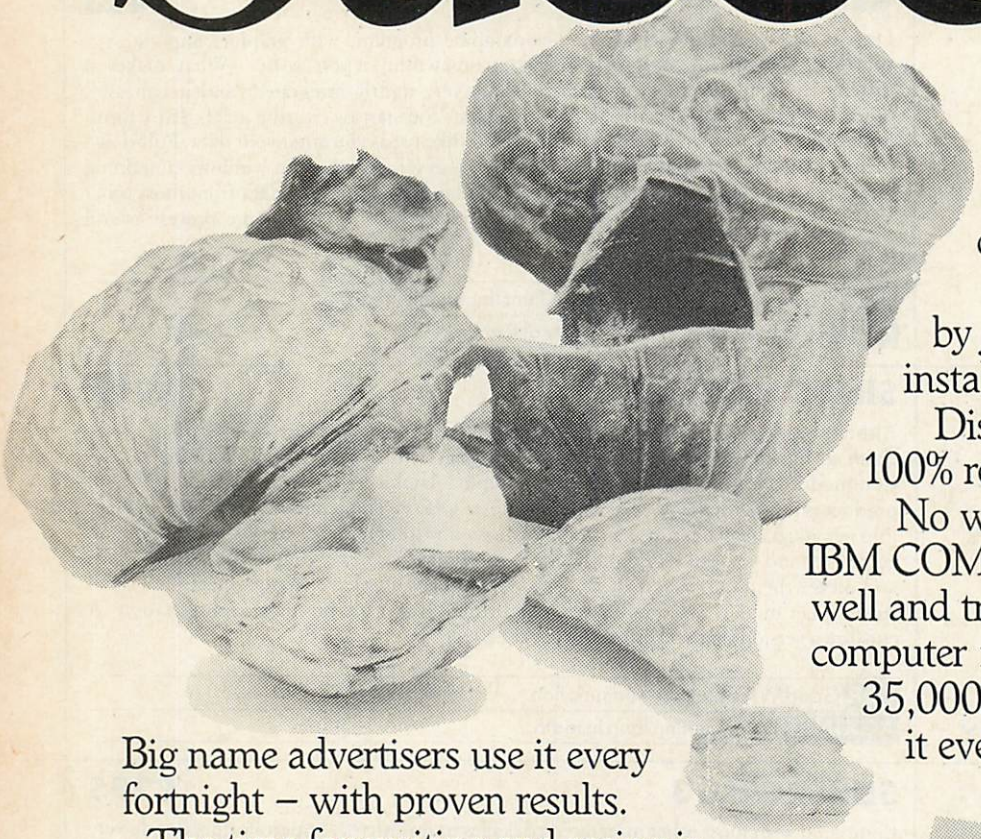
SYMPHONY £595

By adding word processing and communications, Lotus hoped to create a genuine all-in-one program. In fact the package has been criticised as complicated to learn, slow in use and too big — it requires 384K just to run. However, it is very professionally produced and has some excellent features for business users — in particular a very good spreadsheet. Lotus has now announced an upgraded 1.1. version, free to all current purchasers. An improved installation program, revised documentation and tutorial program should make it easier to learn. It can now benefit from an arithmetic co-processor and up to 4Mbyte of additional RAM, if you have them. Optional add-ons include a spelling checker.

FOR Excellent spreadsheet. Good comms.

AGAINST Expensive. Memory hungry.

Success!



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3½" Diskettes	1	2-4	5-9	10-19	20+
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550 D/S 48 tpi	23.90	21.90	20.90	19.90	18.90
577 S/S 96 tpi	23.90	21.90	20.90	19.90	18.90
557 D/S 96 tpi	28.90	26.90	25.90	24.90	23.90
High Density (IBM PC AT)					
5¼" Diskettes	1	2-4	5-9	10-19	20+
MDHD 1.6 MB	46.90	44.90	43.90	42.90	41.90
3½" Microdisk	1	2-4	5-9	10-19	20+
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MF360D/S	44.90	43.90	42.90	41.90	40.90

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MD2-D D/S 48	29.90	27.90	26.90	25.90	24.90
MD1-DD S/S 96	29.90	27.90	26.90	25.90	24.90
MD2-DD D/S	34.90	32.90	31.90	30.90	29.90
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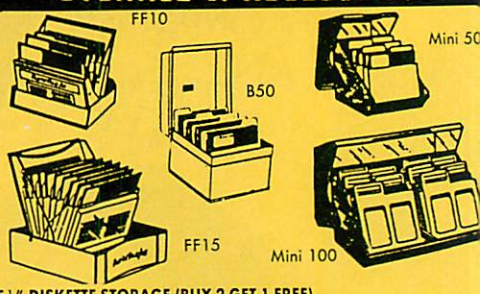
STORAGE & ACCESSORIES



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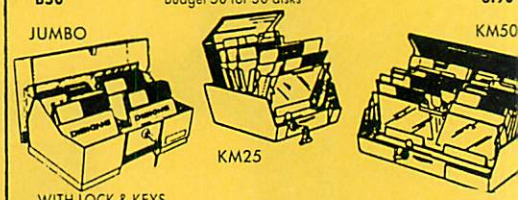
B50	Budget 50 for 50 disks	8.90



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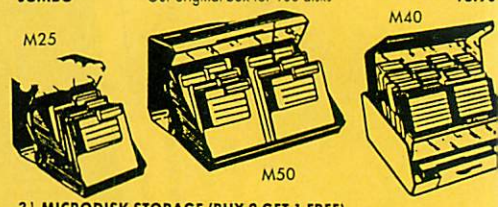

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Our Alpha 10 removable cartridge mass storage unit gives you a faster way to get 20 Mbytes SAFELY stored.

Just one of a whole range of removable cartridge units with capacities from 5Mb to 40Mb, the Alpha 10 is faster than most Winchesters but with the convenience and ease of use of floppies.

You can use the Alpha 10 with almost any micro. As well as the IBM PC it's compatible with ACT Sirius, Apricot, Apple, Commodore and Digital.

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- Floppy-like robustness and ease of use.
- Both cartridges removable for absolute data security.
- 20Mb on-line capacity - expandable to 40Mb on-line and infinite off-line capacity.
- Copies 10Mb in 3 minutes (dependent on host).
- Full back-up and restore utilities for use with integral hard disk.
- Highest reliability of any disk system and simplest to service.
- 35 m. sec access time.
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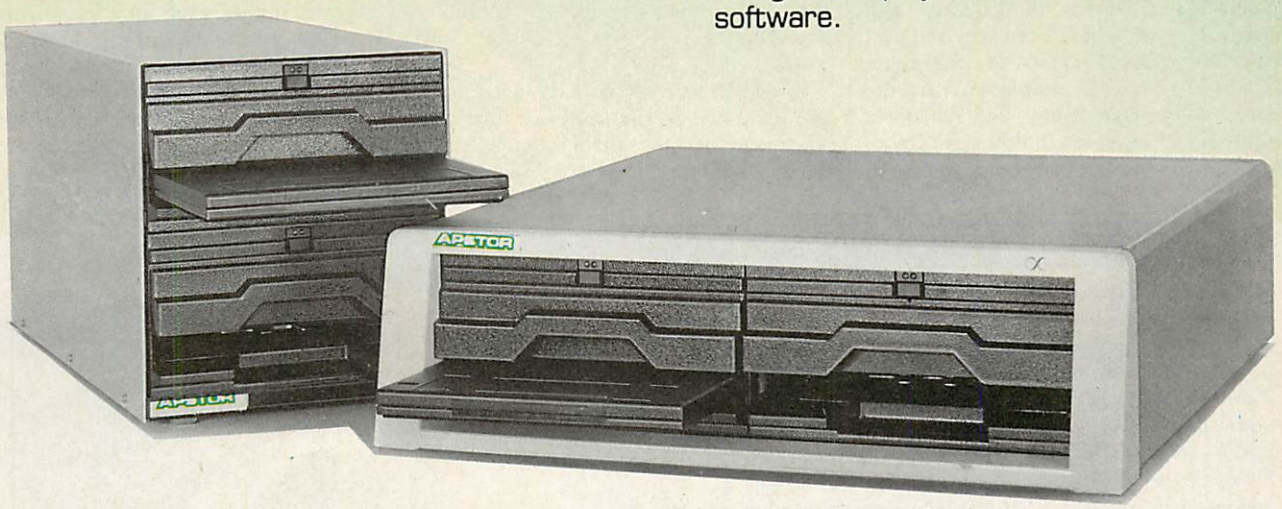
- "Plug in and play" installation with user-friendly software.



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(continued from previous page)
contents specified by the user need special programming equipment and, in the case of EPROMs (erasable, programmable read-only memories) special ultraviolet erasing equipment as well.

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TAPE CASSETTE

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MICRODRIVES AND STRINGY FLOPPIES

The Microdrive has some of the advantages of audio tape cassettes, but unfortunately has most of the disadvantages as well, while adding some new problems that are all its own.

The capacity is not enormous at 100K and there are troubles with tape quality, and reliability of storage and retrieval. Repeatability when putting the same Microdrive cartridge into two different drives can also be a problem. Microdrives try to get round the lack of random access by speeding up the tape and making it a closed loop like the now defunct eight-track audio-tape cartridge. This, and the reduction in tape width, is what causes the reliability trouble.

Worst of all from the Microdrive user's point of view, virtually no one is distributing software on Microdrive cassettes apart from Psion, and most cassette software cannot be easily copied on to them at home. Further, no one except Sinclair makes or supports the drives or media. Microdrives are fine if you don't mind all your fragile eggs going into one fragile-looking basket.

The same goes for similar fast tape drives produced by Rotronics, with the Wafadrive, and the original Stringy Floppy drive produced by Exatron for the Tandy model 1. As you would guess from the last one, these tape units have been around along time without even threatening to displace floppy discs.

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mass storage

Bubble memory uses semiconductor technology, but is not volatile, and can be used as a substitute for a floppy disc. Immediate Business Systems supplies a bubble add-on that works with most micros. Bubble units hold 128K and cost £129 each. Telephone: (0908) 568192.

BUBBLE MEMORY

There is a lot of misunderstanding about bubble memory chips, mainly because they are built using semiconductor techniques. But bubbles have more in common with fast tape drives and floppy discs than with ROM or RAM.

They work by shuttling long strings of magnetic domains around tracks in the surface of a crystal of yttrium-aluminium garnet. The presence or absence of a domain at a detection gate signals a 1 or a 0.

As there might be a wait for a particular lump of wanted data to come round the mountain to the gate, and even then the data being retrieved is serial, bubble memory is slower than ROM or RAM. Bubble memory is in fact comparable with floppy-disc storage and retrieval speeds.

The advantages of bubble are that the stored data is non-volatile, like ROM, thanks to a permanent magnet in the chip packaging which keeps the magnetic domains polarised. Further, there are no mechanical or moving parts to go wrong.

As a result, bubble has found a niche in military and aerospace applications where reliability and security of data are more important than cost. And it is cost that is the main drawback. Today's bubble-memory chips hold a megabit of data — four times as much as current RAM chips — but at well over four times the cost; 100 times might be nearer the mark. Even in comparison with floppy discs, the cost of bubble in terms of cents per bit is very much higher.

Companies like Rockwell — which put its bubble memory in the Space Shuttle — Texas Instruments, Intel, Motorola, Plessey in the U.K. and Fujitsu in Japan, invested heavily in bubbles as the floppy-disc replacement technology. But floppies got smaller, more reliable and cheaper, while bubbles never had any volume sales to bring the price into competition.

It was always supposed to be the 1Mbit chips that would do it. Now the players still in the bubble game are pinning their hopes on the 4Mbit chips that are on the way. Rockwell, TI, Motorola and Plessey have all pulled out completely, while Intel and Fujitsu still carry the flag.

In microcomputers, just two machines use bubble as an integral part of the design: Sharp's 1500 lap-top and Grid's Compass portable. Add-ons are available for the IBM PC and Apple IIe, although they are not too easy to find.

8in. FLOPPY DISC

When Gary Kildall and John Torode cobbled CP/M together on an 8080-based microcomputer with a home-made disc controller and a Shugart floppy drive, the only size of drive available was IBM-format 8in. As a result, CP/M software is still being distributed on single-sided, single-density, IBM-format 8in. discs. These discs hold around 250Kbyte each.

Now 8in. floppies can be found holding up to 2Mbyte, but very few people are using them. Interestingly, the 1.2Mbyte 5.25in. floppy drives on the IBM PC/AT are in fact 1.6Mbyte capacity drives from Mitsubishi that were developed to mimic 8in. floppies in the smaller size.

Most of the big floppy-drive names like Control Data and Shugart still make 8in. drives, as do Mitsubishi and NEC in Japan. NEC even puts them into its APC. The advantages of 8in. floppies are reliability — thanks to widely spaced tracks and sector information — and high storage capacities. The disadvantages, which normally outweigh them, are fragility and the very expensive drives and media they need. Nowadays, 8in. floppy discs look simply enormous.

5.25in. FLOPPY DISC

The undisputed champion of the floppy-disc market worldwide, 5.25in. floppies are also the champions of format incompatibility. Unlike the IBM standard in the 8in. market, 5.25in. drives never had a standard format or capacity until the IBM PC and MS-DOS imposed the 320K and 360K sizes on the industry.

The smallest-capacity 5.25in. floppy on the market was probably Atari's 77K 810 drive, while the highest today is Drivetec's 2.7Mbyte drive licensed to Kaypro for the Robie machine. All capacities in between, in every conceivable format have probably been built by somebody, somewhere. Mike Lewis explains some of the compatibility problems, and how to overcome them, in the section which begins on page 111.

The drives themselves are also built by almost everybody, with the result that a single micro from a single factory can look different each week, as drives with different door mechanisms from a variety of makers are used to put them together.

(continued on page 104)

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- Copies 10Mb in 3 minutes (dependent on host).
- Full back-up and restore utilities for use with integral hard disk.
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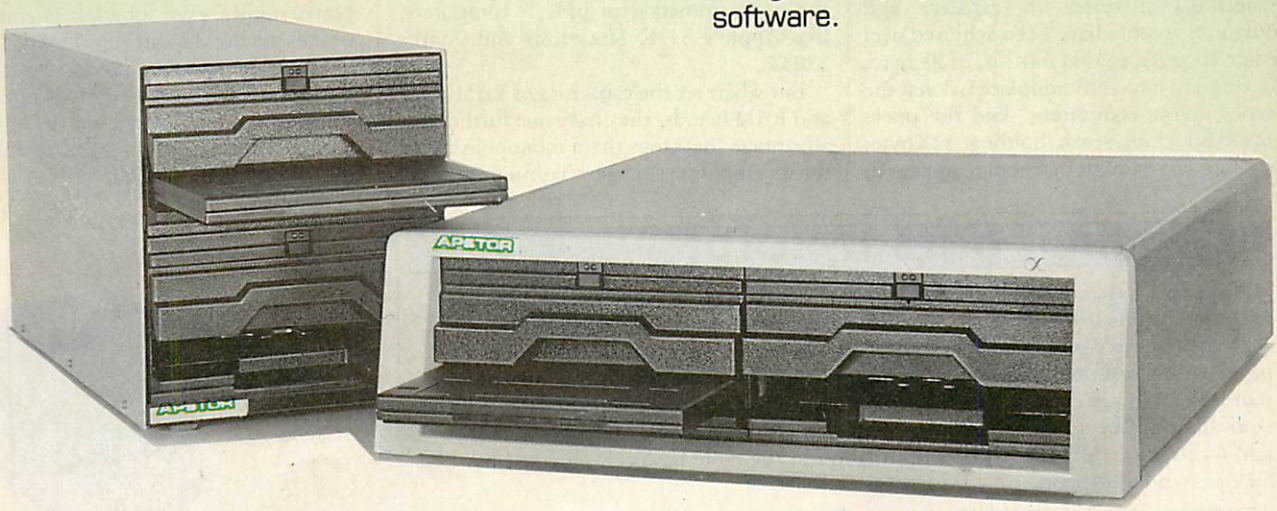

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mass storage

BITS & PIECES

OFF AND ON THE SHELF

OF THE NUMEROUS TECHNIQUES THAT HAVE APPEARED FOR STORING DATA IN QUANTITY, SOME HAVE BECOME STANDARD COMPONENTS WHILE OTHERS SANK WITHOUT TRACE.

ALL PRACTICAL COMPUTING depends upon mass storage. Without it, you would have to type in your word-processing program every morning before starting work, and no data could be held on file electronically.

Nowadays, of course, we have progressed beyond the primitive storage media of earlier times — 80-column cards, punched paper tape, etc. — to the stage where floppy-disc drives are almost taken for granted. Almost, but not quite. There are, in fact, dozens of competing technologies, ranging from bubble memories to cartridges of video tape — the Sinclair Microdrives — to laser discs. Further, even within the established disc market there are several different drives from 8in. to 3in., different types of packaging, and both floppy and hard varieties.

This article provides an overview of storage techniques to help you pick the useful approaches from among the mass. In the first part we look at the pros and cons of the established systems. In part two, we move to the leading edge, where the action is. Finally, we examine those areas where the technology is still being developed.

Choosing a mass-storage device is not simple. Depending on the application, choosing the most cost-effective solution requires a delicate balance between factors like capacity, speed of operation, convenience, security and price.

RAM

■It was obvious at the very beginning of microcomputing that semiconductor RAM — random access memory — was the ideal storage medium. Data could be stored and retrieved at electronic speeds, and the contents of RAM could be changed at will under program or operator control.

The disadvantages, in those early days, were that RAM chips cost a lot of money and did not hold much information. The originals held just 256 bytes per chip, and building up a circuit board holding 4Kbyte was a non-trivial undertaking costing $1,000.

Continual increases in capacity and production volume have been achieved over the last 10 years, so that 64Kbit, or 8Kbyte, on a chip are now commonplace in even the cheapest home computers. And the prices of 256Kbit chips, each holding 32Kbyte, are falling fast enough for them to appear in the more upmarket of today's computers, like Apple's 512K Macintosh and Atari's 520ST.

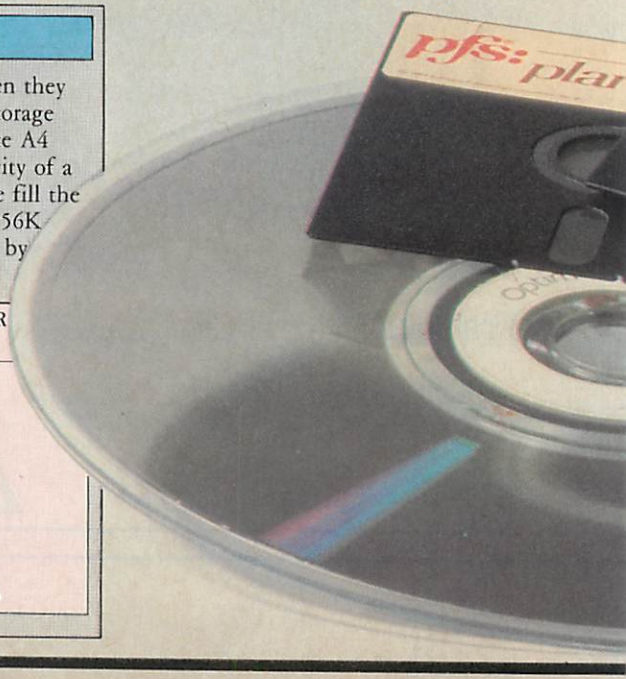
But whatever the capacities of RAM chips and RAM boards, they have one further disadvantage that stops them monopolising all microcomputer storage. Turning off the power supply, even for a few microseconds, trashes all the data in the chips.

Speed of random access, flexibility of operation and, now, enormous capacity are still not enough for users to risk large quantities of important data to RAM and the whims of the CEGB.

HOW MUCH DOES IT HOLD?

Most people have trouble grasping the capacities of mass-storage devices when they are given in bits or bytes. The following table, therefore, translates typical storage capacities into a comprehensible form — a sheet of typewritten, double-space A4 paper which will normally hold about 2,000 eight-bit characters or the capacity of a standard 80-by-25 display screen. The contents of one A4 page will therefore fill the equivalent of one 16Kbit RAM chip, four pages will fill a 64K, 16 pages a 256K and 64 pages a 1Mbit chip. The information in the table has been provided by Siemens and Polygram.

STORAGE MEDIUM	CAPACITY UNIT (KBIT)	A4 PAGES	DENSITY (BITS/mm²)	TRANSFER (KBIT/S)
A4 page	16	1	0.5	0.1
RAM or ROM	256	16	10,000	5,000
Bubble memory	1,000	60	15,000	50
Floppy disc	560,000	35,000	15,000	15,000
Magnetic tape	720,000	45,000	1,000	10,000
Holographic	10×10^6	630,000	10^6	100,000
Compact disc	15×10^6	940,000	270,000	4,500
Optical disc	$20{,}000 \times 10^6$	1.3×10^6	2×10^6	10,000
Human brain	10^{12}	62.5×10^6	10^6 per mm³	0.001-0.05



RAM would be the ideal form of mass storage, if only it was cheaper and more permanent. However, it is now feasible to have large amounts of RAM in small micros. This board from Protek, for Hewlett-Packard computers, holds 2Mbyte. Telephone: 01-245 6844.

ROM

Semiconductor ROM was also used early in the development of microcomputing, particularly when the pioneers found themselves loading a Basic interpreter into their machines by setting front-panel switches. It obviously makes sense to keep programs like the Basic interpreter permanently stored in the system, along with housekeeping routines that are used over and over again.

The big advantage of ROM is that it keeps its contents even if the power supply is removed, so it was ideal for the job. The disadvantage is that the contents cannot be easily changed if, say, only a few bytes need alteration. ROMs that can have their

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contents specified by the user need special programming equipment and, in the case of EPROMs (erasable, programmable read-only memories) special ultraviolet erasing equipment as well.

ROM capacities have lagged behind RAM for most of their development time, but 256Kbit ROM chips are now available. They have their contents installed during manufacture, and are called mask ROMs. A typical use is the storage of system and graphics routines in the Apple Macintosh.

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BUBBLE MEMORY

There is a lot of misunderstanding about bubble memory chips, mainly because they are built using semiconductor techniques. But bubbles have more in common with fast tape drives and floppy discs than with ROM or RAM.

They work by shuttling long strings of magnetic domains around tracks in the surface of a crystal of yttrium-aluminium garnet. The presence or absence of a domain at a detection gate signals a 1 or a 0.

As there might be a wait for a particular lump of wanted data to come round the mountain to the gate, and even then the data being retrieved is serial, bubble memory is slower than ROM or RAM. Bubble memory is in fact comparable with floppy-disc storage and retrieval speeds.

The advantages of bubble are that the stored data is non-volatile, like ROM, thanks to a permanent magnet in the chip packaging which keeps the magnetic domains polarised. Further, there are no mechanical or moving parts to go wrong.

As a result, bubble has found a niche in military and aerospace applications where reliability and security of data are more important than cost. And it is cost that is the main drawback. Today's bubble-memory chips hold a megabit of data — four times as much as current RAM chips — but at well over four times the cost; 100 times might be nearer the mark. Even in comparison with floppy discs, the cost of bubble in terms of cents per bit is very much higher.

Companies like Rockwell — which put its bubble memory in the Space Shuttle — Texas Instruments, Intel, Motorola, Plessey in the U.K. and Fujitsu in Japan, invested heavily in bubbles as the floppy-disc replacement technology. But floppies got smaller, more reliable and cheaper, while bubbles never had any volume sales to bring the price into competition.

It was always supposed to be the 1Mbit chips that would do it. Now the players still in the bubble game are pinning their hopes on the 4Mbit chips that are on the way. Rockwell, TI, Motorola and Plessey have all pulled out completely, while Intel and Fujitsu still carry the flag.

In microcomputers, just two machines use bubble as an integral part of the design: Sharp's 1500 lap-top and Grid's Compass portable. Add-ons are available for the IBM PC and Apple IIe, although they are not too easy to find.

8in. FLOPPY DISC

When Gary Kildall and John Torode cobbled CP/M together on an 8080-based microcomputer with a home-made disc controller and a Shugart floppy drive, the only size of drive available was IBM-format 8in. As a result, CP/M software is still being distributed on single-sided, single-density, IBM-format 8in. discs. These discs hold around 250Kbyte each.

Now 8in. floppies can be found holding up to 2Mbyte, but very few people are using them. Interestingly, the 1.2Mbyte 5.25in. floppy drives on the IBM PC/AT are in fact 1.6Mbyte capacity drives from Mitsubishi that were developed to mimic 8in. floppies in the smaller size.

Most of the big floppy-drive names like Control Data and Shugart still make 8in. drives, as do Mitsubishi and NEC in Japan. NEC even puts them into its APC. The advantages of 8in. floppies are reliability — thanks to widely spaced tracks and sector information — and high storage capacities. The disadvantages, which normally outweigh them, are fragility and the very expensive drives and media they need. Nowadays, 8in. floppy discs look simply enormous.

5.25in. FLOPPY DISC

The undisputed champion of the floppy-disc market worldwide, 5.25in. floppies are also the champions of format incompatibility. Unlike the IBM standard in the 8in. market, 5.25in. drives never had a standard format or capacity until the IBM PC and MS-DOS imposed the 320K and 360K sizes on the industry.

The smallest-capacity 5.25in. floppy on the market was probably Atari's 77K 810 drive, while the highest today is Drivetec's 2.7Mbyte drive licensed to Kaypro for the Robie machine. All capacities in between, in every conceivable format have probably been built by somebody, somewhere. Mike Lewis explains some of the compatibility problems, and how to overcome them, in the section which begins on page 111.

The drives themselves are also built by almost everybody, with the result that a single micro from a single factory can look different each week, as drives with different door mechanisms from a variety of makers are used to put them together.

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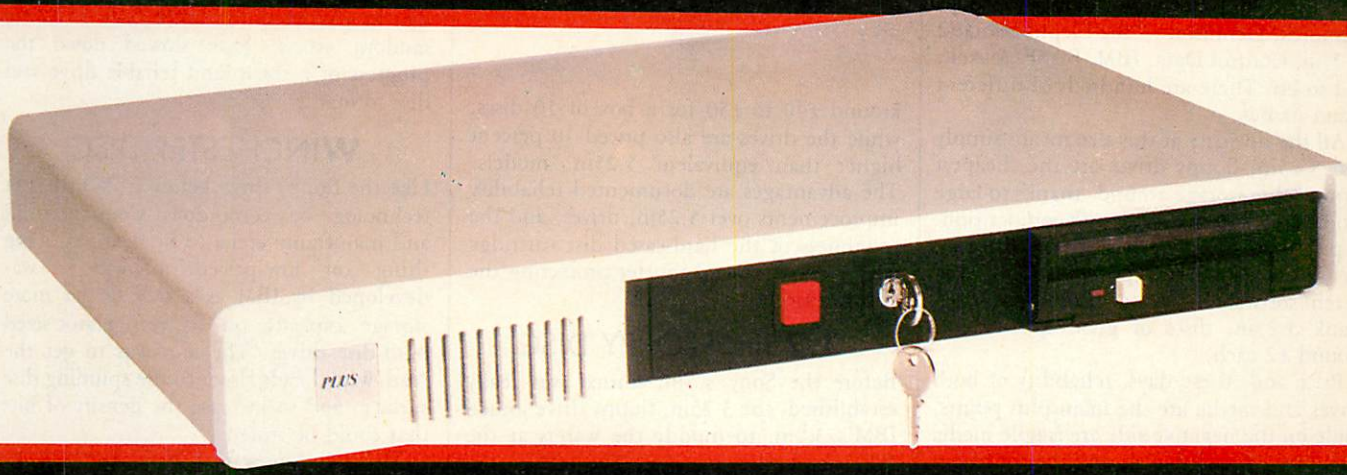

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(continued from page 102)

The big names in 5.25in. drives are Tandon, Control Data, Mitsubishi, Teac, Epson, Shugart, Siemens, NEC, and many more, while in media the names are Verbatim — now part of Kodak — Dysan, Memorex, Dennison — the Elephant brand — Fuji, Control Data, IBM, BASF, Maxell, and so on. There are hundreds of different brand names.

All the diversity at this size means simply that 5.25in. floppy drives are the cheapest form of disc storage around, thanks to large production volumes and stiff competition. A price of £140 on a basic 100K drive — including controller, power supply and system software — is not uncommon, while blank 5.25in. discs of good quality cost around £2 each.

Price and, these days, reliability of both drives and media are the main plus points, while on the negative side are fragile media with limited useful lives, and the confusion of formats.

3.9in. FLOPPY DISC

The 3.9in floppy was a maverick IBM announcement which has never appeared, prompting scurrilous rumours that IBM only announced it to prevent an IEE committee selecting the Sony 3.5in. design as the sub-5.25in. standard. In fact, the only drive in this size is a cartridge Winchester from Syquest, of which more later. IBM, like everyone else, is now buying 3.5in. drives, and may soon be making its own.

3.5in. FLOPPY DISC

Sony in Japan introduced the 3.5in. floppy drive and hard-cased disc to the world around five years ago, and has been working hard ever since — both behind and in front of the scenes — to get drive and disc established as a universal sub-5.25in. standard.

Sony impressed Hewlett-Packard with the unit, and HP decided to standardise on it for all its computers. Hence the company's contortions when trying to launch the supposedly IBM-compatible HP 150 machine with IBM-incompatible floppy drives. More recently, Apple and ACT have standardised on the Sony product for all their current and future computers, and the other leading floppy-drive makers — Tandon, Teac and the like — have produced 3.5in. models.

With 135 tracks per inch, the standard Sony drive can store up to 360K on a single side of the formatted shutter-protected disc, and 720K on the double-sided version. Apple, in typical cavalier fashion, gets 400K on to a single-sided disc by varying the motor speed of the drive, just as the old Sirius/Victor used to do.

Double-sided drives with 1.44Mbyte per disc are just about in existence now, on the Data General One for exaple, and that must be regarded as near the theoretical maximum with current technology.

The media come from Sony itself, Maxell, Memorex, Verbatim, Fuji and Hewlett-Packard. They are expensive at around £40 to £50 for a box of 10 discs, while the drives are also priced 10 percent higher than equivalent 5.25in. models. The advantages are documented reliability improvements over 5.25in. drives, and the toughness of the hard-cased disc cartridge with a sliding metal shutter protecting the disc surface.

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3.25in. FLOPPY DISC

Before the Sony 3.5in. format was really established, the 3.25in. floppy drive joined IBM's 3.9in. to muddy the waters at the IEEE standards committee. The 3.25in. disc looked like a smaller 5.25in. model, in the same flexible jacket rather than a Sony-style hard-cased cartridge.

This format was backed by Dysan and Brown Disk, who were making the media, and by Tabor, who was designing and building the drives. Sadly for them, none of the major manufacturers jumped at the 3.25in. standard, and only two machines emerged in versions using them: one of Seequa's Chameleon portables and one of Jonos's similarly luggable machines.

The format is now thoroughly dead, despite performance comparable with 3.5in, much easier and cheaper media production, and cheaper drives. The disadvantages — basically, fragile media and the lack of major hardware backing — were just too much. Both Dysan and Brown Disk now make 3.5in. discs.

3in. FLOPPY DISC

In the sub-5.25in. standard wars, Sony's main competitor was Hitachi. While U.S. companies like Hewlett-Packard and Apple were taking up the 3.5in. drives, Japanese firms were signing up in numbers for Hitachi's 3in. version.

Hitachi, like Sony, encased the disc itself in a plastic case with a sliding protective shutter to make the media more robust. But unlike Sony, the Hitachi drive was flippable: users could use both sides of the disc just by taking it out of the drive and turning it over. This meant that an effectively double-sided drive could be made with single-sided drive hardware. The capacity of the 3in. format is either 250K or 500K per side.

Hitachi has made its mark at the low end of the micro market, most visible here with the Oric's floppy drive and now as the standard disc unit on Amstrad's line. If Sir Clive had gone to Hitachi with an order for 100,000 drives two things would have happened. They would have jumped at it and given him a rock-bottom price to establish market share, and the QL would have had more in common with the Amstrad 664 and 6128 than with a dog.

The 3in. floppy is a fringe product despite the OEM deals, and few disc makers produce media. The exception is Maxell, through its Hitachi-Maxell tie-up in Japan. The lack of ready disc sources, the flippability, and the way data is stored on the disc in a serial spiral rather than with true random access, have slowed down the progress of a cheap and reliable drive and disc format.

WINCHESTER DISC

Like the floppy drive before it, Winchester technology has come down from the mini and mainframe arena to be next year's big thing on low-priced micros. It was developed by IBM as a way to get more storage capacity on its refrigerator-sized hard-disc drives. The aim was to get the read/write heads closer to the spinning disc surface, and so increase the density of bits that could be stored.

The solution was to give the head an aerofoil section and use the lift generated by the airflow of the spinning disc to fly the head a micrometre or so above the surface. With the heads that low, a particle of dust would block the gap and the head would crash into it, and so crash the drive. So Winchester discs and heads have to be sealed into an enclosure with a filtered airflow.

This technology, and the similar Whitney technique developed from it, allows up to 160Mbyte of data to be stored on a boxed-in stack of discs fitting in the same space as a full-height 5.25in. floppy drive. Half-height and third-height Winchesters storing up to 40Mbyte are now commonplace.

The advantages of Winchesters are high capacity in small spaces, very fast storage and retrieval speeds — 80 milliseconds to access any block of data is typical — and very high reliability. The disadvantages were, until recently, high prices, the fact that sealed Winchester disc units could not be removed like floppies, and the problem of backing up megabytes of data on low-capacity floppy discs or on very expensive tape streamers. Not to mention the drives' susceptibility to vibration, which makes it difficult to build them into portable machines.

Now a 10Mbyte Winchester for the Apple II and IBM PC, the Sider from Xebec-subsidiary First Class Peripherals, is available ready to run for $695 or $795 respectively, mail order only, or £795 in the U.K. More typically, a 10Mbyte external drive costs around $1,500 or £1,500 ready to go, including power and interface and software. These prices are falling, and Jack Tramiel promises a $500 Winchester for the Atari ST machines this year.

Leading manufacturers of bare Winchester drives are Control Data, CMI, the U.K.'s own Rodime, Shugart, Seagate, Fujitsu, Tandon and Miniscribe. Makers of add-ons using these drives are legion, including Symbiotic, Plus 5 and ICE in the U.K., Tallgrass, Tecmar, Quantum, Corvus and many others.

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(continued from page 104)

CMOS RAM

■Many RAM chips are now being made using complementary metal oxide semiconductor (CMOS) technology. The advantage of CMOS, is that its chips use very little power, produce little radio interference, and are therefore ideal for battery-powered computers.

The disadvantages, until recently, have been that CMOS chips are harder to manufacturer than conventional NMOS chips, and that CMOS RAM chips have much lower capacities than NMOS ones. Although both disadvantages have now been overcome, there is still a price premium on CMOS RAM chips.

But CMOS RAM is now starting to be used in small quantities, with battery backup, as malleable ROM. The low power consumption of the chips means that a typical watch or radio or camera battery can keep the CMOS memory contents secure for a year or two. ACT's Apricot and Apple's Macintosh use CMOS RAM and batteries to drive their real-time clocks and to store system configuration data, but capacities are still small.

So far no one is offering a megabyte of CMOS RAM on an IBM PC board, complete with battery, as a disc drive or ROM replacement with even higher speed. But it can only be a matter of time. CMOS RAM is less risky than ordinary RAM, thanks to battery backup. It is also fast and reliable, and can be removable. All these things are desirable if the right capacities can be bought for a reasonable cost.

RAM DISC

RAM discs — also called virtual discs and silicon discs — are the product of falling RAM prices, which have made it sensible for IBM PC owners, say, to buy a couple of megabytes of RAM space, even though the operating system will only address 640K. The most effective way to use this extra RAM is by fooling the machine into thinking that it is a very fast disc drive. This is generally done in software — the VDisk utility in PC-DOS 3.0 is a case in point — with no changes to the hardware.

RAM discs suffer from all the advantages and disadvantages of RAM in ordinary use. They are fast, particularly for a program like WordStar that has to keep going to disc for program overlays, but they lose their contents when the mains goes off. You therefore need some form of off-line storage like a floppy disc or Winchester to save data on at the end of the day. One possible option is to combine RAM-disc software with battery-backed CMOS RAM.

EAROM AND EEPROM

Various attempts have been made to marry the security of ROM storage with the random-access and changeability of RAM. The EAROM (electrically alterable ROM) was an early attempt that suffered because it needed high currents to alter its contents, and took time to do it as well. It is now rarely seen outside laboratories.

EEPROM, or "E-squared PROM" as it is sometimes known, is a better proposition. This is electrically erasable programmable ROM, and first came to public notice in 1982 when a group of engineers left Intel to form Seeq Technology. Seeq was formed purely to take advantage of EEPROM technology, and once the dust of lawsuits and countersuits had settled it started to produce.

The advantage of EEPROMs is that they can be wholly erased or altered by the kind of voltages and currents generated in computer circuits rather than in the mains, and that the changes can be made relatively quickly. This means, for example, that a washing-machine program stored in EEPROM could be altered by the washing machine's microprocessor to cope with changes in the machine caused by wear or different ambient temperatures.

The idea of modifiable, non-volatile program storage is a tempting one for military and aerospace applications, and for other applications too. But EEPROM is not all that fast, and seems unlikely to replace any ROM or RAM in mass-market microcomputer products.

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THE STATE OF THE ART

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HIGH-CAPACITY FLOPPY DISC

The launch of the IBM PC/AT in August 1984 was the first most people had seen of the 1.6Mbyte floppy drive, built originally for compatibility with 8in. floppies. These drives use no special techniques in drive or media, apart from tighter engineering and production tolerances giving 96 track per inch performance.

The advantages are simply higher capacity at similar or higher access speeds, while the disadvantages are slightly reduced reliability and the need to buy certified high-density media. Inmac, for instance, will not guarantee its Lifetime Guarantee discs in an AT or in AT-compatible drives, which is just as well since at least a third of the tracks on Inmac's top-quality discs would not format on the AT. Now 3M, one of the disc-making majors, is moving into high-capacity 5.25in. floppies and has launched an HD line of discs; they work well but cost over £50 per box of ten.

Bernoulli drives use removable media, which gives them most of the advantages of floppies. But they store much more information — typically 10Mbyte per cartridge — which makes them competitive with hard discs. The Apstor Alpha 10 is a twin-drive unit; 10Mbyte of data can be copied from one to another in three or four minutes. Telephone: (0273) 422512.

THE BERNOULLI DRIVE

Iomega, the Utah-based company which developed Bernoulli storage technology, is a little upset that people dismiss it as a 10Mbyte floppy drive — although with a name like that it is an easy mistake to make. In fact, Bernoulli drives are nothing like any other kind of disc storage.

The medium is, true enough, a flexible disc coated with magnetic material and encased in a hard plastic cartridge with sliding shutter. But there is no hub, and no motor in the drive box to spin it. The disc is spun by injecting air into the cartridge at high speed, and — thanks to the principle of laminar flow and differential pressure named after Daniel Bernoulli — the disc is lifted and spun.

The heads in the drive are fixed, and the spinning disc is lifted against the head by its spin, working in the opposite way to Winchesters. According to Iomega, this makes Bernoulli drives more reliable. If the power goes, for instance, the disc just falls away from the head rather than crashing into it. Also according to Iomega, the drives are up to three times faster than Winchesters with access times around 35 milliseconds.

The advantages of Bernoulli drives are that the discs are removable and can store — only in theory so far — up to 50Mbyte with faster access than hard disc. Current sizes are 5Mbyte and 10Mbyte. The disc is protected by a hard case, and is less susceptible to damage because of drive failure. There are also fewer moving parts than in a hard disc.

The disadvantages are few, apart from the cumbersome 8in. cartridges and drives currently being shipped by Iomega, though half-height 5.25in. Bernoulli drives are now becoming available. Other disadvantages are the low capacity compared with modern Winchesters, and the premium price of

around 10 percent over a Winchester of the same capacity.

In the U.K., Iomega drives are being built into add-on storage systems by Micro Technology, with the Honeycomb for the IBM PC, and by Apstor in Brighton. The major distributor, Borsu, has also just launched a range of subsystems in the U.K. aimed at a wider range of machines than the other two, including ACT's Apricot F1 and F1e.

MICRO-WINCHESTER DISCS

Winchester discs, which started out with diameters of 14in., have followed floppies down the size scale. When 5.25in. floppy drives emerged, Winchester drives filling the same holes soon appeared. When half-height and third-height 5.25in. drives were released, Winchesters followed suit. Now that 3.5in. floppy drives are being used in volume, the 3.5in. micro-Winchester is on the market. There is even one which fits on to a standard IBM PC expansion card.

The first to announce 5Mbyte and 10Mbyte 3.5in. drives was the Scottish company Rodime, and the first to announce a machine with them in was Scottish manufacturer ACT — with a factory directly opposite Rodime's — in a machine called the Apricot XI. Other manufacturers — familiar names like Tandon, Seagate, Miniscribe and the rest — have brought out their own drives, all following Rodime in designing the units to fit 3.5in. floppy front-panel slots.

One advantage of the 3.5in. Winchester is that it can be mounted on shock absorbers and floated behind a full-height 5.25in. floppy panel. This is the technique used, with Rodime drives, in the Compaq Plus portable. Rodime in fact anticipated this by building in mechanisms to lock the disc and the heads instantly when the power is shut off.

Otherwise the performance of the micro-Winchesters is the same as their big brothers', but in a smaller space. Their disadvantages are also the same: they are fixed discs needing backup at high prices. Around 80Mbyte seems to be the absolute top capacity of a 3.5in. drive, or 50Mbyte for pessimistic pundits.

CARTRIDGE WINCHESTER DISCS

While fixed Winchesters have been moving into the micro market, work has been feverishly going on to perfect a removable cartridge Winchester drive. This would get round the backup problem, since a fixed Winchester could be backed up on to a removable cartridge and the cartridge locked away somewhere. The problem is in maintaining the inherent reliability of a Winchester when the disc needs to be removable.

The solution adopted by some manufacturers, such as Dysan and Amcodyne, was to make the cartridge comprise the head assembly as well as the disc. This, of course, makes the cartridges much more expensive to make and buy, and reliability is still compromised by leaving the innards of the drive momentarily exposed to pollution as the cartridge is inserted or removed. Still, cartridge drives using 8in. Winchesters are here, at the top end of the market, holding 10Mbyte or 20Mbyte.

At the low end there is just the Syquest 3.9in. cartridge drive, used by Tecmar and Plus 5 among others. It uses a simpler 5Mbyte cartridge reminiscent of a 3.5in. floppy, and is thus more susceptible to pollution. Nevertheless, Syquest and its OEMs insist that reliability is good, and that exchangeability problems when using a cartridge written on one drive in another are a thing of the past.

Audio tape is no one's choice of storage medium, but fast tape streamers are the most practical way of backing up large-capacity hard discs. The TG-5000 and TG-6000 from Tallgrass Technologies, include a hard disc from 25Mbyte to 80Mbyte plus a 60Mbyte tape cartridge in one sub-system. Tel: (0256) 460666.

RANDOM-ACCESS TAPE

The advantages of old-fashioned tape storage, the type shown on the spinning reels of ancient science-fiction films, were high capacity and reliable sequential storage. Microdrives try to add some random access tape, and Corvus is now trying to add some random-access to tape to its networks. The point Corvus is trying to make — as is Apricot, which sells Corvus's Bank under an Apricot logo — is that a 100Mbyte random-access tape drive can sit on a network, solving hard-disc backup problems and giving network users direct access. The penalty is that users may have to wait a few seconds, or tens of seconds, for the data, and there is little evidence so far that they accept the argument.

More conventionally, tape streamers are coming down in price and offer 10Mbyte to 100Mbyte on a small tape cassette for backup purposes. The lack of random access makes them unsuitable for on-line use, but archival records can go on worse media.

READY NEXT WEEK

. . . OR NEXT YEAR, OR MAYBE NEVER.

WAFER-SCALE RAM DISC

■Last March, Sir Clive Sinclair deflected questions about the future of Sinclair Research by going on about wafer-scale integration. This technique takes semiconductor technology to a logical conclusion: since chips are made a thousand or so at a time on a silicon wafer five or six inches in diameter, and then cut up, why not link all the chips on the wafer and keep it one piece?

The advantage is that a single wafer could contain — even using today's technology — a thousand or two 256Kbit RAM chips. That means around 30Mbyte of RAM on one five-inch wafer, assuming that all the chips work properly. Make this in CMOS, provide an auxiliary power supply like a long-life lithium battery, and you have a Winchester-scale RAM disc.

The problems with wafer-scale RAM are the same as those for separate RAM chips, with a few extra ones to do with production. It is hard to make a chip five inches across that works in every particular, especially when you remember that 30 percent or more of chips made on a wafer are thrown away as faulty. You can get around this by only connecting up the working parts of the wafer, but the interconnections themselves are a major problem, since they must all be made accurately as the last production step of the wafer. An error here and the whole wafer has to be junked, rather than just one-third of it.

Wafer-scale integration has been chased by Gene Amdahl's Trilogy company, financed by Sperry, and dropped as too expensive without big enough returns in short time scales. It remains to be seen whether Sinclair's organisation keeps going long enough to produce a plug-in QL RAM-Winchester.

VERTICAL RECORDING

Research into magnetic recording materials has been constant throughout disc development, to cut down abrasion of the read/write heads and improve disc life. Vertical recording comes out of materials research, and promises multi-megabyte floppy drives.

The theory is that the oblong ferromagnetic domains of the vertical recording material do not have to lie flat, but can be stood on end, and so take up less space. Each one can still carry one bit of information. The result is that the density of the recording medium in bits per inch is greatly increased, and with a suitable drive it is possible to increase floppy capacities dramatically. Toshiba has launched a 10Mbyte 3.5in. floppy disc and drive in

(continued on page 110)

MBC 885 £1,390 + VAT.* MS-DOS 2.11. 256K RAM expandable to 640K. 2 x 360K drives. RGB colour/mono outputs. Centronics printer port. Seven IBM-compatible expansion slots. Provision for hard disk. Twice as fast as IBM PC. Free Wordstar 2000 software. Full IBM compatibility.

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(continued from page 107)

Japan, although it has not yet appeared in a micro product.

The disadvantages are those of floppy discs in general, only more so — problems of pollution, alignment of the heads on narrow tracks, and so on. However, for Winchesters, vertical recording has real promise. Their sealed environment means that pollution is no problem, and the heads can be engineered to close enough tolerances to read the dense data. Anyone for a 200Mbyte 3.5in. Winchester?

CD ROM

The coverage of CD ROM, or ready-recorded compact laser discs, in the computer world seems odd, as they boil down to gigabyte-scale Winchesters that do not allow the user to store any data. The applications for that seem small and rather trivial: atlases, bibles and encyclopaedias perhaps, but what else?

The advantages are robust media, with non-contact optical reading techniques, fast access to mixed data that can be video, graphics, text, or hi-fi sound, and capacities around 500Mbyte. The disadvantage — and it is a crucial one — is that it is read-only.

WORM LASER DISC

The Worm (write-once read-many) drive has been around since 1978, when Philips demonstrated a 12in. optical data disc based on its video-disc technology. The data disc stored a gigabyte (1,000Mbyte) on one side, as a pattern of burned pits in a thin, plastic-coated tellurium layer. Increasing the power of its laser head burned a pit; cutting the power enabled the head to detect pits by bouncing light off them.

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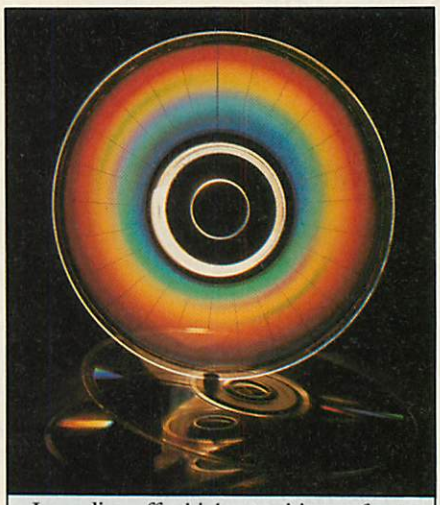

Laser discs offer high capacities — from 500Mbyte to 2,000Mbyte — but are hard to write to and impossible to erase for reuse. The medium may be a compact audio disc or a video disc, or a special credit card as used in the Drexler system. Companies involved include Control Data, Hitachi, Verbatim, Tallgrass, Optotech and Optimem, whose Optimem 1000 was first shipped about a year ago. Telephone: (04862) 27272.

This product is still not on the market, although Philips does sell a $100,000 archival system built around it. Other products using identical techniques, but also very expensive, have come from Shugart's Optimen division, 3M and Toshiba.

The advantages of Worm discs are exceptionally high capacity, fast access comparable to Winchesters, and archival storage of file changes. If you want to change a file, you have to make a copy, change it, and put it back on the disc somewhere else, leaving the original. Every change to every file on the laser disc is recorded as a result of the drive mechanism, which should please auditors.

The disadvantage is price, although in cost per megabyte, Shugart's $12,000 drive works out very reasonably. At those capacities, and with discs costing tens rather than hundreds of dollars, the fact that the disc's data cannot be erased doesn't seem to matter too much.

MAGNETO-OPTICAL DISC

In August this year, Verbatim released details of a 40Mbyte 3.5in. drive that it plans to launch in late 1987. Now 40Mbyte would not be very impressive, except this is not a Winchester but a combination of magnetic and laser technologies promising 600Mbyte on a 3.5in. disc before the end of the decade.

The Verbatim magneto-optical disc is written by a combined laser and magnetic process. Like vertical recording on floppy discs, the process aligns magnetic domains in a thin metallic layer on the disc. Reading is done by bouncing a plane-polarised light beam through the layer. The plane of polarisation is rotated when it meets a written domain. Verbatin is so far on its own with this type of storage, since most of the other disc makers are concentrating on the compact disc size, and purely optical storage and retrieval techniques.

SCI-FI DEPARTMENT

Lasers and holography could save ancient technologies like microfilm and microfiche from complete obsolescence by turning film spools and fiche into high-capacity data-storage media. Holography works by building an interference pattern from two halves of a laser beam. One half shines on a plate or film covered with photographic emulsion, while the other half shines on the same plate after bouncing off an object. Thanks to the coherence of laser light, all the information about the object can be reconstructed from the film or plate by illuminating it with a laser or, sometimes, by plain white light.

In particular, a three-dimensional image can be reconstructed. In holographic data storage a page of text or graphics, say, could be used as the object and stored on film or fiche as a hologram 1mm. square. The advantages of this technique for certain applications are immense. Each fragment of a hologram contains all the information needed to reconstruct an image of the object, so damage to a piece of fiche would just make the damaged page of data dimmer when viewed, without loss of data. The disadvantages are the usual ones of microfilm or fiche cataloguing, since the computer's power cannot be used to select particular words, say, from a fiche. In addition there is the possibility of using optical techniques to compare interference patterns in hologram data, which holds out hopes of fast and reliable pattern recognition.

Since computers are no more than collections of electronic on-off switches, other types of switch should work just as well. One that has been brought up is the optical switch, using changes of refractive index in a crystal to transmit or block a beam of light. The advantage would be switching speed, which would be in picoseconds or even femtoseconds. The disadvantage is that the devices do not seem, at present, to have any hope of being small enough to use those speeds usefully.

Cambridge physicist Brian Josephson came up with what have become known as Josephson junctions; they use boundary semiconductor conditions at temperatures close to absolute zero to form logic and memory gates. These devices, like the optical gates, switch in nano- or picoseconds. But that means that devices must be very small and close together, since otherwise the signal that a gate had switched would not reach the next element until the original gate had switched again. In other words, even at the speed of light, the message would be out of date. Even then, the unit would need to be immersed in a bath of liquid helium to work. IBM and the big Japanese corporations, notably NEC and Matsushita, spent a lot of time and money on Josephson circuits, but they all seem to have given up now. More conventional circuitry seems to be filling their needs.

Biochips, the organic analogues to silicon chips, seem to be Langmuir-Blodgett films, and speculation has been rife over the last two years that films could be grown to emulate electronic circuits. That is as far as it goes as yet — and there have even been reports of uncontrolled growth in the films, like a kind of organic brainstorm.

mass storage

CURES FOR FLOPPY HEADACHES

MIKE LEWIS LOOKS AT THE VARIETY OF DISC SIZES AND FORMATS, AND HOW YOU CAN TRANSFER DATA FROM ONE SYSTEM TO ANOTHER.

Arguably the greatest benefit arising from IBM's supremacy in the world of micros is that a partial cure is now in sight for that curse of computer users: the incompatible floppy format. With vendors falling over themselves to follow the undisputed leader, there is at last something approaching a standard for 5.25in. floppy discs. So long as you, your colleagues and your business associates all use equipment which has a trace of IBM compatibility, the chances are that you can now exchange data and text with a minimum of fuss.

Alas, it was not always so. For the first half-dozen years in the history of the floppy-based micro, manufacturers seemed to take a perverse delight in making their disc formats as different as possible from the next person's. The rot really set in with CP/M 2.2, which handled disc parameters in a table-driven manner, making fiddling with the formats a piece of cake. So with several hundred different varieties of micro-computers in the field, popping a floppy disc out of one machine and into another was quite a headache.

Unfortunately, the problem is still with us. It is true that most computers that use 5.25in. drives and MS/PC-DOS share a common disc format. Also, these machine now outsell any other type of business computer. But the largest group of installed systems is still the eight-bit Z-80 based CP/M family, so incompatible disc formats are likely to be around for some time.

Now one person's problem is another's marketing opportunity, so it was only a matter of time before programs started to appear that allow the computer to read and write discs in foreign formats. Of course, such a program cannot get round physical differences, like recording density and number of sides. But most of the factors that make discs incompatible are defined by the operating system and so can be bypassed by a knowledgeable programmer.

Most of the disc-copying programs on the market are simple, inexpensive products, although a few are sold only with dedicated hardware in very expensive packages. But there does not seem to be any single program capable of being run on a wide variety of computers, presumably because of the need to work at a level below that of the operating system.

Even the universal floppy disc appears in a multitude of formats.

One software-only product that we have been looking at is Crossdata, which runs on the IBM PC and most compatibles. Its main job is to copy files between different CP/M formats, or between CP/M and MS-DOS. You can set both the source and the destination to any of 29 pre-defined formats, and you can optionally specify a CP/M user number or an MS-DOS sub-directory.

Having selected your formats, you can display the directory of the source and/or the destination, then choose the files you wish to copy. You do this by moving the cursor to each of the required files and hitting Return, which causes the file names in question to be highlighted. Finally, you tell the program to proceed with the copying, and the highlighted files are duly transferred.

The whole process is menu-driven, and perfectly straightforward. The list of pre-defined formats is pretty comprehensive, the only surprising omission being Superbrain. We pointed out to program's vendor, Systems Constructors Ltd, that the Superbrain format can itself lay a modest claim to being a standard because a number of machines, such as Televideo, LSI Octopus, Transtec and Millbank System 10, offer the ability to read Superbrain discs. Systems Constructors immediately agreed to include it in the next release of Crossdata.

In theory, Crossdata allows you to add new formats yourself, but this option does not work as advertised. You are supposed to be able to display any of the existing format definitions, then copy it and amend it to form the new definition. After some struggling and a phone call to Systems Constructors, we found that you can only do this with the Morrow Micro D definition, a fact that is not even hinted at in the manual.

This apart, Crossdata is a very useful program. If we hesitate to recommend it unreservedly, it is because it is supplied on a disc which is itself copy protected. Systems Constructors says that it will replace a worn or damaged floppy by return of post, but you should nevertheless think carefully

(continued on page 114)

WHY SO MANY DIFFERENT FORMATS?

First, there the physical differences, the most obvious of which is size. Although the 5.25in. floppy is the commonest, there are still many machines around that use the original 8in. variety, as well as a growing number that favour the shirt-pocket sizes below four inches. Among the latter, the Sony-style 3.5in. as used by the likes of Apricot and Macintosh, is jostling for supremacy with Hitachi's 3in. model, favoured by Amstrad and others. Shirts, it seems, do not have standard-sized pockets.

Other physical characteristics include the number of sides and the recording method. The latter is a function of the controller card, and roughly corresponds to single or double density. This factor, together with the drive's stepper-motor pitch, measured in tracks per inch, determines the disc's unformatted capacity.

Then there is the method of sectoring. Most systems follow the soft-sectoring approach originated by IBM. A few, notably Apple and Sirius, also use soft sectoring but by a totally different method, which makes it very difficult for discs written on either of these machines to be read on any other. With hard sectoring, as found in North Star and Comart machines among others, the disc itself is different — you can recognise it by the series of index holes around the hub — and so cannot even be reinitialised for another machine.

Others parameters are dedicated by software, which usually means the operating system working in conjunction with the disc-formatting or initialising program. The sector size determines the amount of data physically transferred at a time, usually a multiple of 128 bytes. The skew defines the number of sectors that are skipped between consecutive reads, to give the software time to buffer the data in RAM.

Then there are factors relating to track numbering. In some systems, track numbers follow the whole of one side of a disc first then the whole of the other. In other cases, they alternate between the two sides. Sometimes tracks are numbered from zero, sometimes from one.

Within CP/M, there are a host of other variables, such as the number of directory entries allowed, the number of file extents per directory entry, and the block length. CP/M directory formats are completely different from those used by MS-DOS, so discs formatted by the two operating systems are mutually incompatible, even when used on the same machine.

It does accounts, projections

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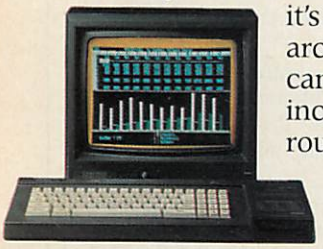

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(continued from page 111)

about using any product which you cannot back up yourself.

A good alternative to Crossdata is a program called Uniform, which runs on the superlative Kaypro range. This has 39 formats — 10 more than Crossdata — although it does not allow the user to add new formats. A major advantage is that the program can be used to initialise a disc in any of the defined formats, which Crossdata cannot do.

The normal way of using Uniform is to set one of the drives to the chosen format, then to exit to CP/M. The drive setting remains in force while you are running subsequent application programs, so allowing you to use foreign discs as if they were native to the machine. You could, for example, create a text file on the Kaypro and edit it on another machine, or vice versa, without any copying or reformatting involved.

Of course, Uniform can also be used to transfer files between formats; you establish the drive setting, then use Pip in the normal way. But it you want to go from one foreign format to another, you have to make a two-stage journey via a Kaypro disc, reinvoking Uniform in mid-trip. Crossdata can do the transfer in one jump.

Uniform also allows you to work with MS-DOS discs. You can display directories, copy files both ways between MS-DOS and Kaypro formats, and delete files. Unfortunately, these operations are very slow. Copying a 50K file from an MS-DOS floppy to the hard disc of the Kaypro 10 took nearly 10 minutes.

There are a couple more minor snags with Uniform. The software that is needed to reconfigure the disc drives stays resident in RAM and eats up a good 7K, a significant chunk of memory in an eight-bit system. Also, there seems to be no way of deleting the configuration from RAM other than by executing a cold boot. But Uniform is such a useful program that we would gladly put up with these irritations.

If your needs are more sophisticated, you might have to consider one of the dedicated disc-copying machines now available. These are aimed at software distributors and computer bureaux, and are not cheap. For example, the Gemini MFB supports over 400 different formats, mostly from the CP/M world but also some for other micros, minis, mainframes and dedicated word processors. A system to handle 8in., 5.25in. and 3.5in. discs starts at around £5,000.

A similar setup is the Timeclaim, which has only slightly fewer formats than the Gemini but which supports 0.5in. open-reel magnetic tape, 3in. discs, and even a built-in EPROM programmer. The machine bristles with interfaces and utility programs, not to mention a disc hopper for bulk copying. The cost is similar to the Gemini.

One format that none of these systems can support is the ever popular Apple II, mainly because of its fundamentally different approach to floppy-disc storage. The normal way to transfer data between an Apple and, say, an IBM PC is to connect the two

mass storage

machines with a serial cable and to use a communications program — a slow and tedious job.

A new product, called Apple Turnover, provides a useful alternative. It consists of an IBM expansion card which you connect to the IBM's disc controller by a ribbon cable. You can leave the card connected without any effect on normal PC use. But once you invoke the Apple Turnover software, one of the IBM drives becomes, in effect, an Apple drive. You can then initialise discs in Apple format, and transfer files both ways between this format and PC-DOS. Appledos and Apple CP/M are both supported.

Another product, called Xeno-Disc, is similar to Crossdata but with a few extras, including the ability to initialise floppies.It also has a handy general-purpose filter program that you can use for making global changes to a file. You can use it, for example, for converting between ASCII and EBCDIC, or for inserting a Linefeed after each Carriage Return.

Finally, if you only occasionally need to move data between machines, it might be cheaper to use one of the many copying services that have set up shop recently. Grey Matter Ltd supports a vast list of formats, and offers a fast turnround by post for around £10 per disc. Quantec is dearer, but will do the copying while you wait, provided you arrange it in advance. Both firms offer discounts for regular work. PC

FLOPPY FORMAT EXCHANGE SOFTWARE

Crossdata, for IBM PC and compatibles, £130 from Systems Constructors Ltd, 30 Christchurch Road, Bournemouth.
Telephone: (0202) 297315.

Uniform, for Kaypro 2, 4 and 10; Kaypro 2 version handles single-sided formats only, from Kaypro dealers; some distributors include a free copy of Uniform with the Kaypro, others make a small charge for it.

Apple Turnover, for IBM PC and compatibles, £300; from Systems Constructors Ltd.

Xeno-Disk, for IBM PC and compatibles; from Systems Constructors Ltd, full program, £325; limited version without formatting option, £150; a similar product, called Hypercross, runs on the Tandy range.

Gemini MFB, from Gemini Microcomputers Ltd, 18 Woodside Road, Amersham, Buckinghamshire.
Telephone: (02403) 28321.

Timeclaim Copier, from Timeclaim Ltd, Marylands House, Bredfield Road, Woodbridge, Suffolk.
Telephone: (03943) 4463.

Grey Matter Ltd, 4 Prigg Meadow, Ashburton, Devon.
Telephone: (0264) 53499 for disc copying by post.

Quantec Ltd, 230-6 Lavender Hill, London SW11 for disc copying on the spot, but make an appointment first.
Telephone: 01-228 7507.

DISC SYSTEM SUPPLIERS

Alloy Computer Products Cotteswold House, Gloucester Street, Cirencester, Gloucestershire GL7 2DQ.
Telephone: (0285) 68709.

Ampex Acre Road, Reading, Berkshire.
Telephone: (0734) 875200.

Apstor Unit 5, Victoria Road Trading Estate, Portslade, Brighton, Sussex BN4 1XQ.
Telephone: (0273) 422512.

Christie Electronics Rodney House, Church Street, Stroud, Gloucestershire GL5 1JL.
Telephone: (04536) 79821.

Control Data Control Data House, 179-199 Shaftesbury Avenue, London WC2H 8AR.
Telephone 01-240 3400.

Dennison Manufacturing Co Colonial Way, Watford, Hertfordshire WD2 4JY.
Telephone: (0923) 41244.

Farnell International Instruments (for Tandberg Data), Sandbeck Way, Wetherby, West Yorkshire LS22 4DH.
Telephone: (0937) 61961.

HAL Computers Invincible Road, Farnborough, Hampshire GU14 7QU.
Telephone: (0252) 517175.

Hitachi Europe Trafalgar House, Hammersmith International Centre, 2 Chalkhill Road, London W6 8DW.
Telephone: 01-748 2001.

ICE Littleton House, Littleton Road, Ashford, Middlesex TW15 1UQ.
Telephone: (07842) 47271.

Immediate Business Systems 3 Clarendon Drive, Wymbush, Milton Keynes MK8 8DA.
Telephone: (0908) 568192.

Interquadram 653 Ajax Avenue, Slough, Berkshire SL1 4BG.
Telephone: (0753) 34421.

Iomega Corporation Keizersgracht 62, 1015 CS Amsterdam, The Netherlands.
Telephone: (+31) 20-231461.

KPG Hardware House (for Idea), 578-586 Chiswick High Road, London W4 5RP.
Telephone: 01-995 3573.

Micro Memory Systems 1 Pincents Kiln, Pincents Lane, Calcot, Reading, Berkshire, RG3 7SD.
Telephone: (0734) 303434.

Micropolis 210 Elgar Road, Reading, Berkshire RG2 0PJ.
Telephone: (0734) 751315.

Newbury Data Recording Unit 4, Hawthorne Road, Staines, Middlesex TW18 3JB.
Telephone: (0784) 61500.

Optimem Corporation AMD House, Goldsworth Road, Woking, Surrey GU21 1JT.
Telephone: (04862) 27272.

Plus 5 Engineering Crowborough Hill, Crowborough, East Sussex TN6 2EG.
Telephone: (08926) 63211.

Protek 10 Grosvenor Place, London SW1X 7HH.
Telephone: 01-245 6844.

Rodime Nasmyth Road, Glenrothes, Fife KY6 2SD.
Telephone: (0592) 774704.

Sony (U.K.) (Components Business). Pyrene House, Sunbury Cross, Sunbury on Thames, Middlesex TW16 7AT.
Telephone: (09327) 81211.

Symbiotic Computer Systems Duroma House, 32 Elmwood Road, Croydon, Surrey CR9 2TX.
Telephone: 01-683 1137.

Tallgrass Technologies (U.K.) Intec Two, Hassocks Wood, Wade Road, Basingstoke, Hampshire RG24 0PI.
Telephone: (0256) 460666.

Tecmar International Westward House, Bramshall, Uttoxeter, Staffordshire.
Telephone: (08893) 2275.

Quintess Woodley Park Estate, Reading Road, Woodley, Reading, Berkshire RG5 3AW.
Telephone: (0734) 696770.

Xebec Systems Cockayne House, Crockhamwell Road, Reading, Berkshire RG5 3JH.
Telephone: (0734) 693511.

OPEN FILE

CONTENTS

In Open File we offer programming tips and free software to key in — from demonstration routines to ready-to-use business programs. As well as major feature programs, every month we publish a selection of software written by our readers.

We welcome serious software for any of the micro systems listed opposite, especially short routines and utilities. Programs can be in machine code, Basic or any other language.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program, which should be listed from a fully debugged, working program. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics, inverse video characters or any other non-standard symbols are either listed correctly or else include Rem statements to explain them fully.

Each program listing, tape or disc must have your name and address on it, or we cannot promise its safe return. A stamped addressed envelope is appreciated.

If you write in with a comment, correction or enquiry please state the machine and the program title.

We pay at least £10 for any programs used, or £35 per page and pro rata for part pages.

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Apple	Bill Hill
BBC	Nicholas McCutcheon
Commodore	Mike Todd
CP/M	Jack Schofield
IBM PC	Jack Schofield
Tandy	John Wellsman
Research Machines	Ian Stobie
Sharp	John Hooper
Sinclair QL	Glyn Moody

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K-SAMPLE TEST

A program from Owen Bishop to detect significant differences between two sets of data.

THOSE READERS who were with us in the early days of the home micro may recall the bogus claims "WYTO washes better", *PC*, December 1979, page 95. The imaginary manufacturer of this super detergent had based this claim on a simple examination of a market survey, without first subjecting it to the more stringent test of a statistical analysis. Our analysis was performed on what was then a the recently released wonder, the Sinclair MK-14, with its hexadecimal keyboard and 256 bytes — yes, bytes, not kilobytes — of RAM. Whatever the limitations of the machine, the analysis showed that the survey had by no means substantiated the claims made for WYTO. In spite of this, the advertisements for the product still continued to proclaim "WYTO washes better".

Years have passed, during which many micros and microcomputer firms have appeared, flourished and disappeared without trace, but WYTO is still with us and the claims for its efficacity are as strongly made as ever. Nowadays, there are three main competitors instead of only one. The manufacturer decided that it was time for another market survey to try to prove its point. In the meantime it had invested in an IBM PC which it was confident could be used to support its assertions.

As in the previous survey, households were supplied with WYTO or one of the rival detergents, brands X, Y, and Z, and asked to rate them on a five-point scale for four features: washing whites, washing coloureds, grease removal and convenience in use. The points were added together for each household to produce a score which could range from 0 to 20. Table 1 shows the results of the survey. Although 40 households had been selected to take part in the survey, one of those testing WYTO was on holiday during the survey period. The brand new brand Z was still at the research stage and there was only enough of it available to supply eight of the households. Fortunately, the test we shall use does not require there to be equal numbers of items in each sample, so missing values do not prevent us from analysing the data.

The total scores for each brand showed that WYTO had the highest total, and the greatest average score. The WYTO advertising department enthusiastically roughed out a sketch for a chart — see figure 1. Then it decided that no one would be interested in the lower part of the chart, so redrew the chart to show only the part that mattered — see figure 2. Somehow, this looked even more effective. All seemed set for a successful advertising campaign.

TABLE 1

	WYTO	Brand X	Brand Y	Brand Z
	16	12	12	19
	10	18	10	16
	18	10	9	17
	16	15	15	13
	19	14	10	18
	—	14	14	15
	13	17	13	13
	18	9	11	12
	15	14	11	—
	17	15	13	—
Total	142	138	118	123
Average	15.8	13.8	15.4	

TABLE 2

	WYTO	Brand X	Brand Y	Brand Z
	27	10	10	36.5
	4.5	33.5	4.5	27
	33.5	4.5	1.5	30
	27	23	23	14
	36.5	18.5	4.5	33.5
	—	18.5	18.5	23
	14	30	14	14
	33.5	1.5	7.5	10
	23	18.5	7.5	—
	30	23	14	—
Total ranks	229	181	105	188

Then the company statistician, who has been running the k-sample program on the IBM PC, dropped a bombshell. Despite the fact that WYTO had the highest average score, had a 19 and two 18s, and had no 9s, its rating was not significantly better than any of its competitors. Indeed, there was no evidence to show that any one of them was better or worse than any of the others.

Statistical theory provides several tests for comparing two sets of values. The k in the name k-sample indicates that this test can be used to compare any number of sets of data to detect if there is any significant difference between them. In the example under discussion, k is 4. The test begins by assuming that there is no difference between the sets of values, that is, between the scores obtained for the four detergents. We then try to prove that this assumption is wrong, or at the least, highly unlikely to be right.

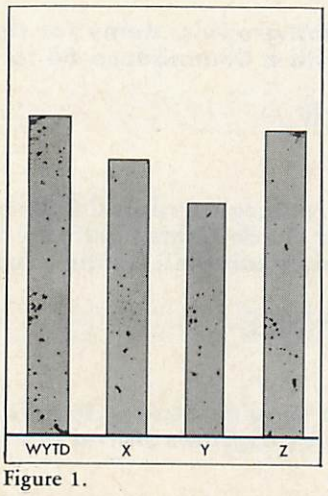

Figure 1.

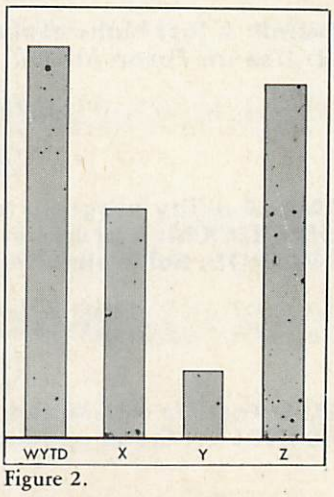

Figure 2.

Before beginning the test we convert the data into ranks, as shown in table 2. Normally, the ranks would run from 1, the lowest score, to 37, the highest score. However, where the same score has been awarded more than once and there are ties, the rank awarded is the average rank. Thus, the lowest score of 9 appears twice so the corresponding rank is 1.5, the average of rank 1 and rank 2. Score 13 appears five times, at ranks 12 to 16, so the corresponding rank is 14. This test may be used with measurement data such as the scores in this example, or with data that has already been collected as ranks.

When we state that there is no difference between detergents, we are saying that a set of figures such as table 2 might just as well have been filled in at random. A simple way of doing this is as follows. Write the ranks on 37 cards and place the cards in a hat. Draw them from the hat one at a time and enter the values obtained in the columns of the table.

We need to know how many such random tables it is possible to produce. The number of different ways of writing 37 ranks in 37 places in a table is factorial 37, written as 37!. This is a very large number, since it is obtained by the multiplication of

$$37 \times 36 \times 35 \times \ldots \times 3 \times 2 \times 1$$

Many micros can not handle numbers larger than 33!, so we are going to need special techniques to deal with this.

However, of this large number of possible tables, there are many that are identical with one another from the point of view of the analysis. To start with, the order of the figures within the columns does not matter. Since there are 10! ways of placing 10 figures in a column of 10 rows, the 37! tables will include many tables with identical sets of values for brand X, for example. Eliminating the tables in which the columns merely have the same figures arranged in different orders, the number of distinct tables is

$$37!/(9!\ 10!\ 10!\ 8!)$$

Secondly, we are not setting out to show which particular detergent is best or worst. We are looking only for an overall effect. Consequently, a table which has a given set of figures for brand X and another set for brand Y is identical with a table having the columns of figures transposed between these two brands. There are 2! such ways of swapping between the two columns which have 10 entries. The other columns have 9 and 8 entries each, so no swapping is possible. The total number of distinct tables is therefore:

$$37!/(9!\ 10!\ 10!\ 8!\ 2!)$$

Even with these divisors, the

USING THE PROGRAM

1. Enter the number of columns and the number of rows. The number of columns is the number of different treatments — in this case detergents — to be compared. The number of rows is the maximum number of samples of any treatment; here it is 10.
2. Enter the scores, that is values as in table 1, row by row, column by column, as prompted by the computer. If there is a missing value, enter 9999. You are given the chance to repeat the entries if any are incorrect.
3. The screen displays the message "Sorting and ranking". After a few seconds the table of ranks is displayed as in table 2. Also displayed are the totals for each column and the grand total of ranks.
4. The message "Calculating number of tables" appears and, after a few more seconds, this is displayed. This tells you how many distinct tables could be generated randomly, as calculated by the factorial expression described.
5. Before the computer generates and tests the random tables, you are asked how many are to be tested. The minimum number is 100, but a number as low as this should be used only if you are reasonably certain that the data shows no significant effect. Otherwise, enter 200 for a trial test.
6. Finally, you are asked to enter a probability, expressed as a percentage. Enter 5 for the first run.
7. A message appears telling you how many tables are being generated and examined. It also displays the critical numbers.
8. You will then see a series of numbers displayed one after another. These are to help you gauge how the testing is proceeding. A number appears for each table examined. If you have elected to test 200 tables, you may have to wait for 200 numbers to appear. The number is incremented by 1 each time an extreme table is found.

number of tables is still very large. It is evaluated by the program as 3.571883E + 19. Table 2 is one of those which appear to show that some detergents are rated better than others. We have to discover if table 2 is an exceptional table, or if it is possible to obtain millions upon millions of different random tables, each of which shows one detergent outstanding to an equal or greater extent than WYTO in table 2.

If table 2 is exceptional, the chances of obtaining such a table from the survey are extremely small. This makes it likely that the table is not a random one and that there is an effect due to brand. On the other hand, if this is not an exceptional table, then the survey has provided us with no reason for abandoning our assumption that all detergents are equal, even though WYTO Ltd may add "but some are more equal than others!".

With 37 items of data, the grand total of ranks is always 703, the sum of

$$1+2+3+\ldots+37$$

Obviously we cannot use the column totals as such or their grand total as a way of assessing the extent of the difference, if any, between treatments. The criterion for deciding the overall effect is to take the rank total of each column, square it and then sum the squares. If all detergents were ranked equally, on average the column totals would be 171, 190, 190 and 152. Their sum of squares would be 124,545.

Any difference between columns that is brought about by interchanging a value from one column with a different value from another column results in an increase in the sum of squares. The greater the differences between column totals, the greater the sum of squares. For table 2 the sum of squares is 131,571. We now have to find out how many of the 3.57E + 19 tables have a sum of squares equal to or exceeding 131,571.

One obvious way of doing this is to write out all the tables, and then calculate their sums of squares. Even with a computer, this would take millenia. The alternative, adopted in this program, is a Monte Carlo method. We generate a random sample of possible tables and then determine what proportion of them have sums of squares equal to or exceeding the sum of squares of table 2. These tables are known as "extreme tables". We can decide in advance how many tables to generate. The more tables, the more precisely the result will be known, but the longer the analysis will take. The program allows us to settle on the most suitable compromise between precision and length of run time.

Listing 1 is for the IBM PC

(continued on next page)

LISTING 1

```
10 REM ** k-SAMPLE TEST **
20 CLS:INPUT "How many columns";NCOLS
30 INPUT "How many rows (max)";NROWS
40 DIM DAT(NCOLS,NROWS),ROWS(NCOLS),TOTA
LS(NCOLS),SAME(NROWS),TEST(NCOLS,NROWS),
TTOTAL(NCOLS)
50 CLS:PRINT "Enter data.  Key 9999 for
a missing value.":PRINT
60 FOR J=1 TO NCOLS:PRINT "Column ";J
70 FOR K=1 TO NROWS:PRINT "Row ";K;:INPU
T DAT(J,K)
80 NEXT :NEXT
90 INPUT "All OK (y/n)";ANSWER$
100 IF ANSWER$<>"y" AND ANSWER$<>"n" THE
N 90
110 IF ANSWER$="n" THEN 50
120 CLS:PRINT"Sorting and ranking"
130 FOR J=1 TO NCOLS:FOR K=1 TO NROWS:IF
 DAT(J,K)<>9999 THEN ROWS(J)=ROWS(J)+1
140 NEXT :N%=N%+ROWS(J):NEXT
150 DIM SORT(N%+1),Q(10,2),RANKS(N%+1):S
ORTNO=1
160 FOR J=1 TO NCOLS:FOR K=1 TO NROWS:IF
 DAT(J,K)<>9999 THEN SORT(SORTNO)=DAT(J,
K):SORTNO=SORTNO+1
170 NEXT :NEXT
180 FIRST=1:LAST=N%:GOSUB 1020
190 R1=1:R2=1:R3=1:SORT(N%+1)=SORT(N%)+1
200 IF SORT(R2)=SORT(R2+1) THEN R3=R3+.5
:R2=R2+1:GOTO 200
210 FOR J=R1 TO R2:RANKS(J)=R3:NEXT
220 R2=R2+1:R1=R2:R3=R2
230 IF R2<=N% THEN 200
240 FOR J=1 TO NCOLS:FOR K=1 TO NROWS
250 IF DAT(J,K)=9999 THEN 290
260 CELL=1
270 IF DAT(J,K)<>SORT(CELL) THEN CELL=CE
LL+1:GOTO 270
280 DAT(J,K)=RANKS(CELL)
290 NEXT :NEXT
300 CLS:PRINT"Ranked data":PRINT
310 FOR K=1 TO NROWS:FOR J=1 TO NCOLS:IF
 DAT(J,K)=9999 THEN PRINT "--",:GOTO 330
320 PRINT DAT(J,K),:TOTALS(J)=TOTALS(J)+
DAT(J,K):GTOTAL=GTOTAL+DAT(J,K)
330 NEXT :PRINT"":NEXT
340 PRINT:PRINT"Rank totals":PRINT:FOR J
=1 TO NCOLS:PRINT TOTALS(J),:NEXT
350 PRINT:PRINT:PRINT"Total of ranks = "
;GTOTAL
360 D%=NCOLS
370 FOR K=1 TO NROWS:FOR J=1 TO NCOLS
380 IF ROWS(J)=K THEN SAME(K)=SAME(K)+1
390 NEXT :NEXT
400 NOSAME%=0:FOR K=1 TO NROWS
410 IF SAME(K)>1 THEN NOSAME%=NOSAME%+1
420 NEXT
430 D%=D%+NOSAME%:DIM D%(D%)
440 DCELL=1:FOR K=1 TO NCOLS:IF ROWS(K)>
1 THEN D%(DCELL)=ROWS(K):DCELL=DCELL+1
450 NEXT
460 FOR K=1 TO NROWS
470 IF SAME(K)>1 THEN D%(DCELL)=SAME(K):
DCELL=DCELL+1
480 NEXT
490 PRINT:PRINT"Calculating number of ta
bles"
500 MX%=0:FOR J=1 TO D%:IF D%(J)>MX% THE
N MX%=D%(J):REM factexp begins ***
```

(listing continued on next page)

LISTING 1

(listing continued from previous page)

```
510 NEXT
520 DIM N%(N%-1),R%(D%,MX%-1)
530 FOR J=2 TO N%:N%(J-1)=J:NEXT
540 FOR J=1 TO D%:IF D%(J)=0 OR D%(J)=1
THEN R%(J,1)=1:GOTO 560
550 FOR K=2 TO D%(J):R%(J,K-1)=K:NEXT
560 NEXT
570 J%=0
580 J%=J%+1:IF J%>D% THEN 740
590 K%=0
600 K%=K%+1:IF K%>D%(J%)-1 THEN 580
610 F%=R%(J%,K%)
620 IF F%=1 THEN 600
630 G%=F%-1
640 Q%=N%(G%)
650 FF%=F%:QQ%=Q%
660 IF FF%>QQ% THEN FF%=FF%-QQ%
670 IF FF%<QQ% THEN QQ%=QQ%-FF%
680 IF FF%<>QQ% THEN 660
690 H%=FF%:IF H%=1 THEN 720
700 F%=F%\H%:Q%=Q%\H%:R%(J%,K%)=F%:N%(G%
)=Q%:IF F%=1 THEN 600
710 GOTO 630

720 G%=G%+F%:IF G%>N%-1 THEN 580
730 GOTO 640
740 V=1:FOR J=1 TO D%:FOR K=1 TO D%(J)-1
:V=V*R%(J,K):NEXT :NEXT
750 V=1/V:FOR J=1 TO N%-1:V=V*N%(J):NEXT
:REM factexp ends ***
760 PRINT:PRINT"The number of tables is
";V
770 PRINT:INPUT "How many tables to be t
ested (100+)";TABLES
780 IF TABLES<100 THEN 770
790 PRINT:INPUT "Probability (%)";P
800 IF P<0 OR P>=100 THEN 790
810 IF P=0 THEN END
820 CLS:CRIT=INT(P*TABLES/100):PRINT"Exa
mining";TABLES;"tables.  Critical number
 =";CRIT:PRINT
830 SOS=0:FOR K=1 TO NCOLS:SOS=SOS+TOTAL
S(K)*TOTALS(K):NEXT
840 RANDOMIZE TIMER
850 EXTR=0:DONE=0:WHILE EXTR<CRIT*2 AND
DONE<TABLES+1:PRINT EXTR;" ";
860 FOR J=1 TO NCOLS:FOR K=1 TO NROWS:TE
ST(J,K)=0:NEXT :TTOTAL(J)=0:NEXT
870 FOR J=1 TO N%
880 X%=INT(RND*NCOLS)+1:Y%=INT(RND*ROWS(
X%))+1
890 IF TEST(X%,Y%)>0 THEN 880
900 TEST(X%,Y%)=RANKS(J):NEXT
910 SOSTEST=0:FOR J=1 TO NCOLS:FOR K=1 T
O ROWS(J):TTOTAL(J)=TTOTAL(J)+TEST(J,K):
NEXT
920 SOSTEST=SOSTEST+TTOTAL(J)*TTOTAL(J):
NEXT
930 IF SOSTEST>=SOS THEN EXTR=EXTR+1
940 DONE=DONE+1
950 WEND
960 IF EXTR>=CRIT*2 THEN PRINT:PRINT:PRI
NT"The data show no significant effect a
t the";P;"% level":GOTO 980
970 PRINT:PRINT:PRINT"Probability =";100
*EXTR/(TABLES-1);"%"
980 PRINT:INPUT"Repeat testing";ANSWER$
990 IF ANSWER$<>"y" AND ANSWER$<>"n" THE
N 980
1000 IF ANSWER$="y" THEN 770
1010 END
1020 Q1=1:REM quicksort ***
1030 Q(1,1)=FIRST:Q(1,2)=LAST
1040 Q2=Q(Q1,1):Q3=Q(Q1,2):Q1=Q1-1
1050 Q4=Q2:Q5=Q3:Q6=SQRT(INT(RND*(Q3-Q2)
+.5)+Q2)
1060 IF SQRT(Q4)<Q6 THEN Q4=Q4+1:GOTO 10
60
1070 IF Q6<SQRT(Q5) THEN Q5=Q5-1:GOTO 10
70
1080 IF Q4>Q5 THEN 1100
1090 Q7=SQRT(Q4):SQRT(Q4)=SQRT(Q5):SQRT(
Q5)=Q7:Q4=Q4+1:Q5=Q5-1
1100 IF Q4<=Q5 THEN 1060
1110 IF Q5-Q2>=Q3-Q4 THEN 1150
1120 IF Q4>=Q3 THEN 1140
1130 Q1=Q1+1:Q(Q1,1)=Q4:Q(Q1,2)=Q3
1140 Q3=Q5:GOTO 1180
1150 IF Q2>=Q5 THEN 1170
1160 Q1=Q1+1:Q(Q1,1)=Q2:Q(Q1,2)=Q5
1170 Q2=Q4
1180 IF Q2<Q3 THEN 1050
1190 IF Q1>0 THEN 1040
1200 RETURN
```

(continued from previous page)

or compatible machines, using GWBasic 2.0. Modifications for GWBasic 1.0. and for Apple II and the BBC machines are given in listing 2.

The sequence of using the program is shown in the box on the previous page. If there are very few extreme tables, you may obtain several rows of zeros on the screen, before any 1s appear. It may even happen that all 200 numbers will be zeros. Displays of this pattern indicate that the computer rarely or never finds an extreme table. Most or all of the tables it finds are less extreme than the data table. So the data table is more extreme than most of the randomly generated ones. There is a strong likelihood that the differences between column totals are significant.

On the other hand, you may find that the number is incremented almost every time it is displayed. You may get

0 1 2 2 3 4 4 5 . . .

and so on. This indicates that most of the tables examined by the computer are more extreme than the data table. The data table is not exceptional in any way, and the differences between column totals are insignificant. In such a case it is not worthwhile proceeding with the analysis. This is why you were asked to enter a probability level. If you entered 5, for example, it means that you are not interested in proceeding once the number of extreme tables exceeds five percent of the number tested.

PROGRAM OUTLINE

Lines 10 to 110 input the data into array Dat( ).
Lines 120 to 170 transfer data to arrary Sort( ) prior to sorting.
Line 180 calls a quicksort subroutine — lines 1020 to 1200 — to sort the data into ascending order.
Lines 190 to 230 rank data in Sort( ), placing the corresponding ranks in array Ranks( ).
Lines 240 to 290 scan Sort( ) to find values corresponding to each entry in Dat( ); when found, the corresponding rank is placed in Dat().
Lines 300 to 350 display ranked data, column totals and rank total.
Lines 360 to 490 calculate how many divisors there are and their values.
Lines 500 to 750 are the FactExp routine.
Lines 760 to 810 display number of tables and input number of test tables and probability level.
Lines 820 to 950 generate random tables, calculate their sums of squares, compare with sums of squares of data table, display number of extreme tables found so far.
Lines 960 to 1010 display result and invite repeat test,

LISTING 2

```
1020 DEF PROCquicksortnumber(F%,L%
)
1030 LOCAL left%,right%,temporary,
comparand
1040 left%=F%:right%=L%:comparand=
SORT((F%+L%)DIV2)
1050 REPEAT
1060    IF SORT(left%)<comparand TH
EN REPEAT:left%=left%+1:UNTIL SORT(
left%)>=comparand
1070    IF comparand<SORT(right%) T
HEN REPEAT right%=right%-1:UNTIL co
mparand>=SORT(right%)
1080    IF left%<=right% temporary=
SORT(left%):SORT(left%)=SORT(right%
):SORT(right%)=temporary:left%=left
%+1:right%=right%-1
1090    UNTIL left%>right%
1100 IF F%<right% PROCquicksortnum
ber(F%,right%)
1110 IF left%<L%PROCquicksortnumbe
r(left%,L%)
1120 ENDPROC
```

The critical number shows how many tables need to be examined before abandoning the test. In this example the critical number is 10, which is five percent of 200. In practice, to allow for chance variations which might result in an unduly large number of extreme tables being generated early in the run, the program continues until twice the critical number has been found before terminating. If the critical number is not reached, testing terminates when the all 200 tables have been generated and examined.

If the run is terminated because twice the critical number was exceeded, a message tells you that no significant effect has been detected. This is what happens with the data of table 1. There is no evidence that WYTO washes better. Otherwise it displays the calculated probability. This is the percentage of extreme tables found among the tables it has generated.

If the probability is more than 10 percent, it shows that extreme tables occur fairly frequently. Most people would take this to mean that there is no significant effect.

A value of five percent to 10 percent indicates a possibility of a significant effect. If the probability is six percent for example, it means that if you state that the difference between column totals represents a real difference due to the nature of the data, you are probably correct, but there is a six percent chance that you may be wrong. This is because there is a six percent chance that such a table of data could have been obtained by random selection of data. Thus, this test allows you to obtain an estimate of how right or wrong you are likely to be.

A probability of less than five percent means that the effect is significant, though you may decide that you will not accept this unless the probability of being wrong is very low indeed , say, one percent.

If the probability is very small, tests on 200 tables might show no extreme ones. Probability would be calculated as zero. Or you may obtain only one or two tables, in which case the random element does not allow the probability to be calculated precisely. You have established that the result is highly significant and may be content leave it at that.

If you want to obtain a better estimate of a low probability, it is necessary to repeat the run, generating and examining more tables. The program allows you to do this by asking if you require "Repeat testing?'. This returns you to step 5. Now you enter a large number, say 1,000, and select a lower percentage, say one percent. The run will continue for 1,000 tables or until 100 extreme tables have been found. The run could take 10 minutes or more, so it is not worth doing unless you want to know the probability with some degree of precision.

The operation of the main part of the program is shown in the box opposite. FactExp is a stand-alone routine which has applications in many programs in which combinatorial calculations are involved. Its action is to evaluate expressions of the form:

n!/(r1! r2! r3! r4! . . . rd!)

The number of divisor factorials may be 2 or more. It can be used for evaluating combinations, for which the expression is:

n!/(r! [n-r]!)

Before entering this routine, the following values must be established: N% is the value of n in the expression above; D% is the number of divisor factorials, d in the expression above; D%( ) is an array holding the values of r1, r2, r3 . . . rd, cell D%(0) is not used; MX% is the maximum of r1, r2, r3, . . . rd.

Although many computers cannot evaluate factorials greater than 33!, this routine allows much larger factorials to be dealt with. The limit depends on the final value of the expression. Normally n is larger than any value of r but, if the values of r are sufficiently large and there are several divisors, the final value of expression is within the range of the machine, even when n is 100 or more.

The routine uses exactly the same approach as we would use for evaluating the expression on paper. Large numbers are avoided by cancelling. To consider a simple example, to evaluate:

10!/(3! 2! 4!)

we write out the factors:

2 x 3 x 4 x 5 x 6 x 7 x 8 x 9 x 10/
(2 x 3 x 2 x 2 x 3 x 4)

then we cancel as far as we can:

(1 x 1 x 1 x 5 x 1 x 7 x 4 x 9 x 10/
(1 x 1 x 1 x 1 x 1 x 1)

In this example all the divisors cancel out fully. Cancelling means that only a small value is arrived at when we perform the final multiplication. Instead of having to work with 10!, equal to 3,628,800, we calculate the product of the few remaining factors, which is 12,600.

In FactExp, the factors of n! are held in array N%( ). The factors of the divisors are held in array D%( ), a two-dimensional array. These arrays are dimensioned at the beginning of the routine. If it is intended to use the routine as a subroutine, it is necessary to dimension sufficiently large arrays at the beginning of the program and to clear their contents to zero before calling the subroutine.

Lines 530 to 560 fill the arrays with the appropriate factors of n! and r!. Cancelling is done in lines 570 to 730. J% is an index counting the number of factors of each divisor processed. K% is an index counting the number of factors of each divisor processed. F% is a factor of the divisor currently being cancelled against factors of n!. G% is an index of the factor of n! currently being processed. Q% is the current factor of n!.

At lines 650 to 690, FF% and QQ% are given the values of F% and Q%; we use Euclid's algorithm to find their highest common factor, H%. Line 700 does the cancelling. When all cancelling has been done, lines 740 and 750 evaluate the expression, using the values remaining in the arrays.

When modifying the program for GWBasic 1.0 line 840 should be:

```
840 R%=VAL (MID$(TIME$,7,2)):
  RANDOMISE R%
```

To modify the program for Apple II the longer variable and array names need not be replaced by two-character names, but SosTest should be replaced by ST to avoid confusion with Sos. CLS is changed to Home wherever it occurs. The integer division at line 700 may be replaced by ordinary division using /, since the result is assigned to integer variables. Line 840 is not required. Delete the statements

WHILE . . . EXTR;" ";

from line 850. Replace line 950 by:

```
950 IF EXTR(CRIT*2 AND DONE
  (TABLES+1 THEN PRINT EXTR;
  " ";:GOTO 860
```

You may need to change some of the Print statements to adapt the displays to a 40-column screen.

When modifying the program for the BBC Micro specify Mode 0 or Mode 3. Use Div instead of / at line 700 for integer division. Line 840 is not required. Line 880 becomes:

```
X%=RND (NCOLS):Y%=
  RND(ROWS(X%) )
```

Delete the statements

WHILE . . . EXTR;" ";

from line 850 and replace with the statement Repeat. Replace line 950 by:

```
950 PRINT EXTR;" ";:UNTIL
  EXTR=CRIT*2 OR
  DONE=TABLES
```

alter line 180 to:

```
180 PROCquicksortnumber(1,N%)
```

Then use the quicksort procedure given in the box above to replace line 120 to 1200 of the main program.

FURTHER READING

Handbook of Procedures and Functions for the BBC Micro by Audrey Bishop and Owen Bishop. Published by Granada, 1984.

Statistics for Biology (fourth microcomputer edition) by O N Bishop. Published by Longman, 1983.

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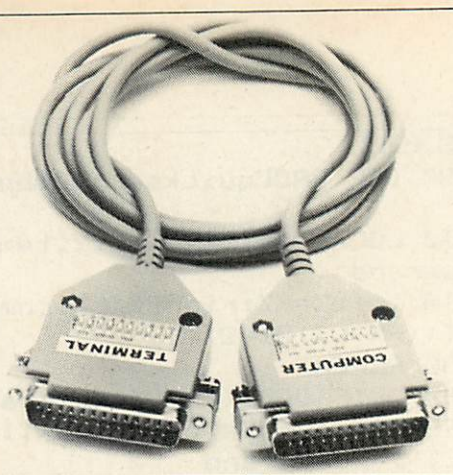

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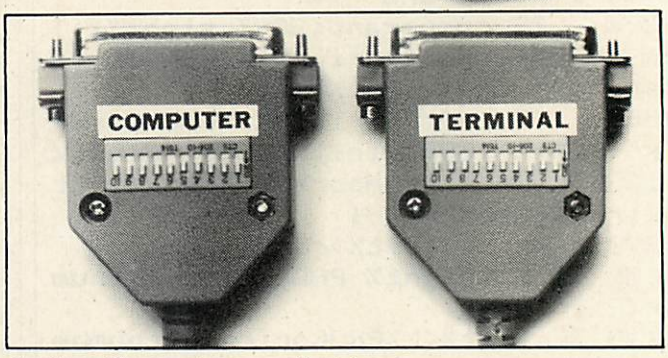

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409.002 See10 5¼" Lib Case each	2.30	2.05	1.95	1.85	1.75

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• Circle No. 214

Mike Lewis explains how to apply standard spreadsheet programs to the task of predicting future requirements.

LOOKING AHEAD

HAVE YOU ever thought how much more profitable your business would be if only you could look into the future? Alas, it is not given to us to foresee next week's share prices or racing results, lucrative as that would be. But on a more mundane level, many businesses find that they can boost their profits by predicting the demand for the various products that make up their inventory.

After all, the inventory is often the lifeblood of the business. It also represents the largest chunk of working capital. Getting inventory levels right is the key to success, but to do so you need an accurate method of forecasting your sales for the days and weeks ahead.

Fortunately, such methods exist, and are widely used by large companies. And although the formulae look a little daunting at first, they are not beyond the ken of most O-level mathematicians. What's more, if you have a spreadsheet program, such as Multiplan or Supercalc, you already have all the software you need to do the job.

A very simplistic approach is to assume that your sales for next month will be equal to the average of sales over the last, say, five months. So the arithmetic is simply a matter of keeping a five-month moving average.

Of course, the period need not be a month. You could just as well do the exercise daily, annually, or something in between. Also, the demand does not have to be in the form of sales. The technique works equally well for supplies components in a factory or use of spares in a workshop.

The trouble with a moving average is that it treats all months equally. In practice, you would expect future sales to be closer to demand in the more recent months than that of several months ago. Furthermore, a moving average is subject to sudden fluctuations. Any exceptional demand will be reflected in the average for five consecutive months, and will then suddenly vanish from sight.

What we need is a way of working out an average which gives a greater weight to more recent events, and in which older events dwindle in importance gradually rather than suddenly. One way of doing this is to calculate what is known as an exponentially weighted moving average. The method of doing this is summarised in the box above as formula 1, and is sometimes called exponential smoothing.

This formula usually produces acceptable results when demand for a product is stationary. Note that stationary demand does not mean fixed demand. It might be subject to dramatic ups and downs, but in the long term these average

(continued on next page)

FORMULAE FOR SMOOTHING

In these formulae, y is the actual demand for a product, u is the forecast demand, B is the trend and S is the seasonal factor. The suffix always represents the month number, t being the current month or other period. So y_t is this month's demand, and u_{t-1} is last month's forecast for this month.

The terms α, β and γ are called smoothing constants, and they always lie between 0 and 1. Their values, which are the subject of much debate, are chosen to reflect the volatility of the data. For our purposes, we can use 0.2, 0.02 and 0.5 respectively.

The basic formula for stationary demand is:

$$u_t = \alpha y_t + (1-\alpha)\, u_{t-1} \qquad (1)$$

This uses last month's forecast as a starting point. In the first month that the formula is used, we would need to make a guess at the demand, just to start the ball rolling.

We can initially calculate the monthly trend as:

$$B_1 = (y_t - y_{t-12})/12 \qquad (2)$$

and thereafter apply the following formula:

$$B_t = \beta(u_t - u_{t-1}) + (1-\beta)B_{t-1} \qquad (3)$$

The seasonal factor for the first 12 months is:

$$S_n = y_n/x \qquad (4)$$

where n is the month number (1–12) and x is the average monthly demand for the year. In subsequent years, the formula becomes:

$$S_t = \gamma y_{t-12}/u_{t-11} + (1-\gamma)S_{t-12} \qquad (5)$$

Incorporating the trend and seasonal factor into the basic formula gives:

$$u_t = \alpha y_t/s_t + (1-\alpha)\,(u_{t-1} + B_{t-1}) \qquad (6)$$

Turning now to the standard deviation, we first work out the forecasting error (e), thus:

$$e_t = y_t - u_{t-1} \qquad (7)$$

The mean absolute deviation (M) is given by:

$$M_t = \alpha \times ABS(e_t) + (1-\alpha)M_{t-1} \qquad (8)$$

and finally:

$$\text{standard deviation} = M_t \times 1.25 \qquad (9)$$

SPREADSHEET 1

Demand for Typewriter Ribbons, Jan - July

(alpha=0.2)

		Jan	Feb	Mar	Apr	May	Jun	Jul
A	This month's sales	150	155	142	159	160	155	145
B	Last month's forecast for this month	145	146	148	147	149	151	152
C	This month's error (A-B)	5	9	-6	12	11	4	-7
D	alpha*A	30	31	28	32	32	31	29
E	(1-alpha)*B	116	117	118	117	119	121	122
F	This months' forecast for next month (D+E)	146	148	147	149	151	152	151
G	alpha*abs(C)	1.00	1.80	1.16	2.47	2.18	0.74	1.41
H	(1-alpha)*prev. I	0.00	0.80	2.08	2.59	4.05	4.98	4.58
I	This month's M.A.D. (G+H)	1.00	2.60	3.24	5.06	6.23	5.73	5.99
J	Est. standard dev. 1.25*I	1.25	3.25	4.05	6.33	7.79	7.16	7.48

(continued from previous page)

out. In practice, demand is rarely stationary, with at least two other factors playing a role.

The first of these is the trend. In spite of the peaks and troughs, there is usually an underlying pattern of growth or decline in the sales of a product. This trend is defined as the average monthly increase in sales over a period of, say, one year. Formula 2 can be used to calculate the trend initially, although once we are into year 2 it would be better to apply exponential smoothing again — see formula 3.

Just to confuse the issue, seasonal factors are themselves subject to trends. The February seasonal factor for sunglasses might tend to increase over the years as more people take winter holidays in sunny countries. We have to be careful to separate this type of trend from the month-by-month trend, so we must once again apply a smoothing formula — see formula 5.

We can now bring the whole thing together, as shown in formula 6. This will work in most circumstances, even if there is no trend or seasonal factor. In these cases, the values of B and S will be 0 and 1 respectively.

Nobody can claim that these formulae will always predict the actual sales. The best that they can do is to provide a set of figures whose discrepancies tend to cancel each other out. These figures can be used to decide the basic stock that should be carried. However, we also need to think about stock needed to cope with unforeseen demand.

To decide about safety stock, we need some way of measuring the discrepancies that find their way into the sales forecasts. The best way to do this is to work out the standard deviation. This is where the mathematics can get complicated, but fortunately we can make do with an easily calculated approximation.

We start by working out the forecasting error. This is simply the difference between this month's actual demand and last month's estimate of this month's demand — formula 7. We then calculate the mean absolute deviation (MAD), which is the average of the absolute values of the forecasting errors over a number of consecutive months. Not surprisingly, we use exponential smoothing to arrive at this — see formula 8. Finally, the approximate standard deviation is found by multiplying the MAD by 1.25.

Spreadsheet 1 shows how a sales forecast and its standard deviation is built up over seven months, omitting the calculation of trends and seasonal factors. Of course, this spreadsheet is merely an illustration and you would not use this sort of model on a working basis. In fact, one of the advantages of exponential smoothing is that you do not need to store historical data in this way, merely carry forward the results of each month's calculations to the following month.

Spreadsheet 2 is closer to a real-life application. To make it really useful, you would need to set it up in a way that allows figures to be carried forward automatically. Next month we will look at ways of using your sales forecast to produce optimum stock levels. PC

SPREADSHEET 2

Sales Forecast for July 1985
(alpha=0.2)

	This Months's Sales	Last Month's Forecast	Smoothed Trend	Smoothed Seasonal Factor	This Month's Forecast	Est. Standard Deviation
Junior toothbrush	40	36	2.5	1.1	38	5.00
Standrd toothbrush	66	70	1.9	0.9	72	5.00
Safty razor holder	12	11	-2.0	0.8	10	1.60
Shaving foam	27	22	1.1	1.0	24	6.30
Razor blade 5-pack	18	19	0.0	1.6	17	1.25
Family health kit	3	2	0.5	3.5	2	1.25
Suntan oil-50 ml.	48	50	11.2	6.7	50	2.90
Suntan oil-100 ml.	70	60	6.2	9.0	55	9.10
Water purifier	16	15	3.0	6.1	15	1.25
Herbal shampoo	12	13	6.6	0.7	19	1.60
Foot powder	9	8	-1.6	4.4	6	1.25

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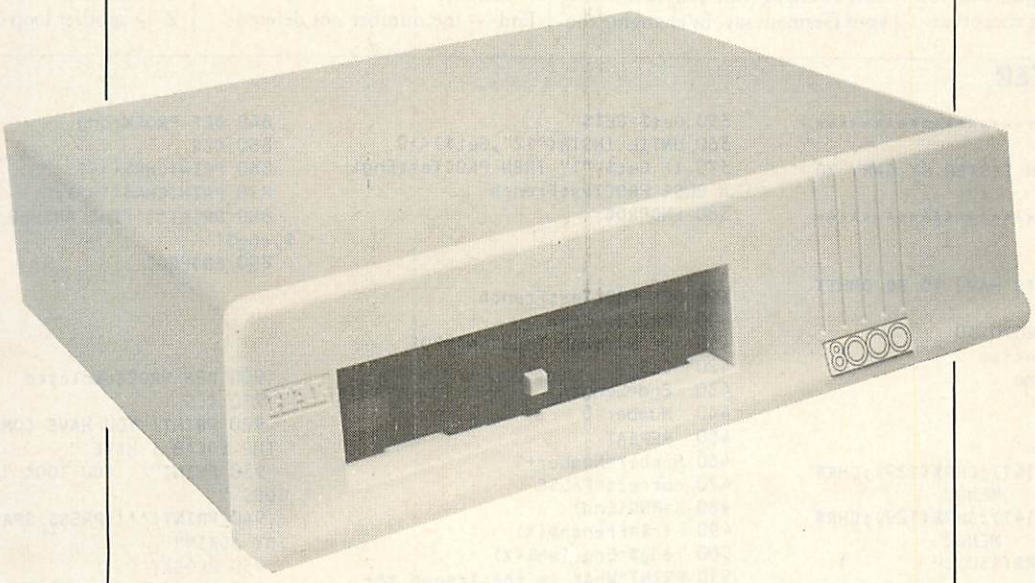

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BY NICHOLAS McCUTCHEON

FRENCH TESTER

GARY MONK is learning French and has sent in the study aid that he has written. The objects in writing the program were to show the use of a simple database, to provide a useful source of revision for people learning languages and to structure a program so that every action was held within a procedure.

There are three ways of entering vocabulary: type it in, load it in from a filing system or use the supplied data in the program. If you wish to list the current vocabulary, use the Learn option on the menu. When using the self-test function, the computer will delete any data that you get right so you end up with none.

A maximum of 1,000 words may be entered but this is variable and can be altered by changing lines 2480 to 2490. It would be fairly easy to change the program to test your German, say, by changing the messages on the screen then giving a new vocabulary.

The variables used in the program are as follows:

French$ — array for French vocabulary
English$ — array for English vocabulary
Length — the number of words in memory
End — the number not deleted
Number — used as a loop variable
X — random pick from vocabulary for test
Get$ — used in Proc to equal keyboard
Menulist$ — in conjunction with Instr
NoVocab — True if no vocabulary in memory
Attempt$ — your response to word question
Channel — to open a file for read/write
Z — another loop counter

FRENCH TESTER

```
    1 REM *************************
***
    2 REM *FRENCH TESTER BY GARY MO
NK*
    3 REM *************************
***
    4 REM
    5  REM ACCENTS HAVE TO BE OMMIT
ED
    6  ON ERROR GOTO 30
   10  PROCInitialise
   20  PROCWelcome
   30 REPEAT
   40  VDU26
   45  CLS
   50 PRINTCHR$(141);CHR$(129);CHR$
(136);"              MENU"
   60 PRINTCHR$(141);CHR$(129);CHR$
(136);"              MENU"
   80 PRINT'''CHR$(130);"        1
LOAD VOCAB"
   90 PRINTCHR$(130);"        2  ENT
ER VOCAB"
  100 PRINTCHR$(130);"        3  USE
 MY VOCAB"
  110 PRINTCHR$(130);"        4  LEA
RN VOCAB"
  120 PRINTCHR$(130);"        5  CHA
NGE VOCAB"
  130 PRINTCHR$(130);"        6  SAV
E VOCAB"
  140 PRINTCHR$(130);"        7  ERA
SE VOCAB"
  150 PRINTCHR$(130);"        8  TES
T YOURSELF"
  160 REPEAT
  170 Get$=GET$
  180  UNTIL INSTR(MenuList$,Get$)<
>0
  200 IF Get$="1" THEN PROCLoadVoca
b
  210 IF Get$="2" THEN PROCEnterVoc
ab
  220 IF Get$="3" THEN PROCReadVoca
b
  230 IF Get$="4" THEN PROCLearnVoc
ab
  240 IF Get$="5" THEN PROCChangeVo
cab
  250 IF Get$="6" THEN PROCSaveVoca
b
  260 IF Get$="7" THEN PROCErase

  270 IF Get$="8" THEN PROCTest
  280 UNTIL FALSE
  290 END

  300 DEF PROCTest
  310 CLS
  320 PRINT"      FRENCH TO ENGLISH
(1)"
  330 PRINT'"      ENGLISH TO FRENCH
 (2)"
  340 REPEAT
  350 Get$=GET$
  360 UNTIL INSTR("12",Get$)<>0
  370 IF Get$="1" THEN PROCTestEngl
ish ELSE PROCTestFrench
  380 ENDPROC


  390 DEF PROCTestFrench
  400  PROCNoVocab
  410  IF NoVocab THEN ENDPROC
  420  CLS
  430  End=Length
  440  Number=0
  450  REPEAT
  460 Number=Number+1
  470 correct=FALSE
  480 X=RND(End)
  490  fr$=French$(X)
  500  eng$=English$(X)
  510 PRINT"What is the french for
";eng$
  520 INPUTattempt$
  530 IF attempt$=fr$ THEN PROCSwap
 ELSE PROCWrong
  540 UNTIL End=1
  550 PROCCompleted
  560 ENDPROC


  570  DEF PROCTestEnglish
  580 PROCNoVocab
  590 IF NoVocab THEN ENDPROC
  600 CLS
  610 End=Length
  615  Number=0
  620 REPEAT
  630 Number=Number+1
  640 Correct=FALSE
  650 X=RND(End)
  660 fr$=French$(X)
  670 eng$=English$(X)
  680 PRINT"What is the english for
";fr$
  690 INPUTattempt$
  700 IF attempt$=eng$ THEN PROCSwa
p ELSE PROCWrong
  710 UNTIL End=1
  720 PROCCompleted
  730 ENDPROC


  740  DEF PROCSwap
  750 French$(X)=French$(End)
  760 English$(X)=English$(End)
  770 French$(End)=fr$
  780 English$(End)=eng$
  790 End=End-1
  800 CLS
  810 PRINTCHR$(141);"        CORREC
T"
  820 PRINTCHR$(141);"        CORREC
T"
  830 ENDPROC
  840 DEF PROCWrong
  850 CLS
  860 PRINTCHR$(141);"        WRONG"
  870 PRINTCHR$(141);"        WRONG"
  880 PRINT''''"THE ANSWER WAS "'fr
$,eng$'
  890 ENDPROC


  900 DEF PROCCompleted
  910 CLS
  920 PRINT'"YOU HAVE COMPLETED ALL
 THE VOCAB I HAVE "
  930 PRINT"   YOU TOOK ";Number;"
GOES "
  940 PRINT''''"PRESS SPACE BAR TO
TRY AGAIN"
  950 REPEAT
  960 UNTIL INKEY(-99)
  970 ENDPROC
  980 END


  990 DEF PROCSaveVocab
 1000 CLS
 1010  LOCAL Get$
 1020 PRINT"Tape or disc"
 1030 REPEAT
 1040 Get$=GET$
 1050 UNTIL INSTR("TD",Get$)<>0
 1060 IF Get$="D" THEN PROCDiskSave
 ELSE PROCTapeSave
 1070 ENDPROC


 1080 DEF PROCDiskSave
 1090  *DISK
 1100  LOCAL Number,Channel
 1110  Length$=STR$(Length)
 1120 REPEAT
 1130 INPUT"WHAT NAME IS VOCAB TO B
E SAVED UNDER";File$
 1140 IF LEN(File$)>7 THEN PRINTTAB
(1,1)"TOO LONG PLEASE RE-ENTER"
 1150 UNTIL LEN(File$)<=7
 1160 Channel=OPENOUT(File$)
 1170 PRINT#Channel,Length$
 1180 Number=0
 1190 REPEAT
 1200 Number=Number+1
 1210 PRINT#Channel,French$(Number)
 1220 UNTIL Number=Length
 1230 REPEAT
 1240 Number=Number+1
 1250 PRINT#Channel,English$(Number
-Length)
 1260 UNTIL Number=Length+Length
 1270 CLOSE#Channel
 1280 ENDPROC
```

```
1290 DEF PROCTapeSave
1300  *TAPE
1310  LOCAL File$,Channel,Number
1320  Length$=STR$(Length)
1330 REPEAT
1340 INPUT"WHAT NAME IS VOCAB TO B
E SAVED UNDER";File$
1350 IF LEN(File$)>10 THEN PRINT"T
OO LONG"
1360 UNTIL LEN(File$)<=10
1370 Channel=OPENOUT(File$)
1380 PRINT#Channel,Length$
1390 Number=0
1400 REPEAT
1410 Number=Number+1
1420 PRINT#Channel,French$(Number)
1430 UNTIL Number=Length
1440 REPEAT
1450 Number=Number+1
1460 PRINT#Channel,English$(Number
-Length)
1470 UNTIL Number=Length+Length
1480 CLOSE#Channel
1490 ENDPROC

1500 DEF PROCEnterVocab
1510  PROCWarning
1520 INPUT"How many words";Length
1530  IF Length>1000 THEN PRINT"To
o many try again":GOTO 1520
1540 FOR Input=1 TO Length
1550 CLS
1560 INPUT"French Word ";French$(I
nput)
1570 INPUT"English  Word "English$
(Input)
1580 NEXT
1590  End=Length
1600 ENDPROC

1610 DEF PROCErase
1620  PROCNoVocab
1630  IF NoVocab THEN ENDPROC
1640  PROCWarning
1650 Length=0
1660 End=0
1670 ENDPROC

1680 DEF PROCLearnVocab
1690  PROCNoVocab
1700  IF NoVocab THEN ENDPROC
1710  CLS
1720 VDU14,26
1725  PRINTTAB(0,23)"        PRESS
SHIFT TO SCROLL"
1726  VDU28,0,20,39,0
1730 FOR Learn=1 TO Length
1740 PRINTFrench$(Learn)," ";Engli
sh$(Learn)
1750 NEXT Learn
1754  VDU26
1755  PRINTTAB(0,23)"        PRES
S SPACE TO CONTINUE"
1756  VDU28,0,20,39,0
1760  REPEAT
1770  UNTIL INKEY(-99)
1780 ENDPROC

1790 DEF PROCLoadVocab
1800 CLS
1810  LOCAL Get$
1820 PRINT"Tape or disc ?"
1830 REPEAT
1840 Get$=GET$
1850 UNTIL INSTR("TD",Get$)<>0
1860 IF Get$="D" THEN PROCDiskLoad
ELSE PROCTapeLoad
1870 ENDPROC
1880 ENDPROC

1890 DEF PROCDiskLoad
1900  PROCWarning
1910  LOCAL File$,Channel,Number
1920  *DISK
1930 REPEAT
1940 INPUT"Enter name of vocabular
y list ";File$
1950 Channel=OPENIN(File$)
1960 IF Channel=0 THEN PRINT"FILE
NOT ON CURRENT DISK"
1970 UNTIL Channel<>0
1980 CLS
1990 INPUT#Channel,Length$
2000  Length=VAL(Length$)
2010 Number=0
2020 REPEAT
2030 Number=Number+1
2040 INPUT#Channel,French$(Number)
2050 UNTIL Number=Length
2060 REPEAT
2070 Number=Number+1
2080 INPUT#Channel,English$(Number
-Length)
2090 UNTIL Number=Length+Length
2100 CLOSE#Channel
2110  End=Length
2120  ENDPROC

2130 DEF PROCTapeLoad
2140  PROCWarning
2150 *TAPE
2160  LOCAL Channel,File$,Number
2170 INPUT"ENTER NAME OF VOCABULAR
Y LIST";File$
2180 Channel=OPENIN(File$)
2190 INPUT#Channel,Length$
2200  Length=VAL(Length$)
2210 Number=0
2220 REPEAT
2230 Number=Number+1
2240 INPUT#Channel,French$(Number)
2250 UNTIL Number=Length
2260 REPEAT
2270 Number=Number+1
2280 INPUT#Channel,English$(Number
-Length)
2290 UNTIL Number=Length+Length
2300 CLOSE#Channel
2305  ENDPROC

2310 DEF PROCChangeVocab
2315  CLS
2316  PRINTTAB(0,23)"¬    CHANGE Y
ES OR NO ?"
2317  VDU26
2318  VDU28,0,20,39,0
2320 FOR Z=1 TO Length
2330 CLS
2340 PRINTFrench$(Z),English$(Z)
2350 REPEAT
2360 Get$=GET$
2370 UNTIL INSTR("YN",Get$)<>0
2380 IF Get$="Y" THEN PROCSwapChan
ge
2390 NEXT Z
2400 ENDPROC

2410 DEF PROCSwapChange
2420  INPUT"New french word";Frenc
h$(Z)
2430 INPUT"New english word";Engli
sh$(Z)
2440 ENDPROC

2450  DEF PROCInitialise
2460  Length=0
2470  MenuList$="12345678"
2480  DIM French$(1000)
2490  DIM English$(1000)
2495  VDU23,1,0;0;0;0;
2496  *FX4,1
2500  ENDPROC

2510 DEF PROCWelcome
2511 CLS
2512 PRINT"    FRENCH TESTER BY GA
RY MONK"
2513 PRINT''''''''''      PRESS SP
ACE TO CONTINUE"
2514 REPEAT
2515 UNTIL INKEY(-99)
2520  ENDPROC

2530 DEF PROCReadVocab
2540 PROCWarning
2550 Length=21
2560 FOR Loop=1 TO Length
2570 READ French$(Loop)
2580 READ English$(Loop)
2590 NEXT Loop
2600 ENDPROC

2610  DEF PROCNoVocab
2620 IF Length=0 THEN NoVocab=TRUE
ELSE NoVocab=FALSE
2630  ENDPROC

2640 DEF PROCWarning
2650 CLS
2660  PRINTTAB(10,10);CHR$(141);CH
R$(129);CHR$(136);"WARNING"
2670  PRINTTAB(10,11);CHR$(141);CH
R$(131);CHR$(136);"WARNING"
2680 PRINT'''CHR$(130);"CONTINUATI
ON WILL RESULT IN ANY VOCAB "
2690 PRINTCHR$(132);"IN MEMORY BEI
NG CLEARED.TO RETURN PRESS"
2700 PRINT'CHR$(129);"    ESCAPE O
R SPACE TO CONTINUE"
2710 REPEAT
2720 UNTIL INKEY(-99)
2730 ENDPROC

2740 DATA ENCHANTE,DELIGHTED,ENNUY
EUX,BORING,ENORME,HUGE
2750 DATA ENRHUME,TO HAVE A COLD,E
NSEMBLE,TOGETHER,EPAIS,THICK,EPATEN
T,FANTASTIC
2760 DATAEPOUVANTABLE,HORRIBLE,ETR
OIT,NARROW,EVIDENT,OBVIOS
2770 DATA EXACT,PRECISE,EXTERIEUR,
OUTSIDE,A L'EXTERIEUR,ON THE OUTSID
E
2780 DATA EXTAORDINAIRE,AMAZING,FA
CHE,ANGRY,FACILE,EASY,FAIBLE,WEAK
2790 DATA FORT,STRONG,FRAIS,FRESH,
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BY MIKE TODD

GRAPHICS PRINTER DUMP

THERE HAVE BEEN many high-resolution graphics dumps for the Commodore 64, but most are in Basic and are very slow. Steve Mehew has provided this fast machine-code program designed for use with one of the Epson-compatible range of printers, such as the FX-80.

The program is unusual in that it contains its own software to drive the printer, using the user port as a Centronics-type interface. Suitable cables are available from Audiogenic, Supersoft and many other suppliers. Alternatively, you could make up your own cable from a Centronics plug, the user-port edge connector and some ribbon cable. The connections are shown in the table.

The routine is executed using

SYS 49152

and the start of the high-resolution screen is assumed to be at location 40960 ($A000), but this can be changed by Poking the high byte of the address into location 49365.

The screen can be printed in inverse by

POKE 49364,128

The source code is also provided to help understand the process, especially the output routine for the Centronics interface which could be lifted for use by other programs. In that case, lines 545 and 546 must also be included to set up the data direction register. It is written with the Mikro assembler but should be convertible for use by others.

Printer	C64
pin 1, strobe	pin M, PA2
pin 2, data 0	pin C, PB0
pin 3, data 1	pin D, PB1
pin 4, data 2	pin E, PB2
pin 5, data 3	pin F, PB3
pin 6, data 4	pin H, PB4
pin 7, data 5	pin J, PB5
pin 8, data 6	pin K, PB6
pin 9, data 7	pin L, PB7
pin 10, ACKN	pin B, FLAG2
pin 16, GND	any GND pin

Computer/printer connections.

GRAPHICS DUMP. BASIC LOADER

```
60 FOR R=49152 TO 49365
70 READ A:POKE R,A:C=C+A:NEXT
80 :
90 IF C<>25938 THEN 200
100 :
110 PRINT "DATA IS ALL CORRECT.":END
120 :
200 PRINT "SORRY, THERE IS AN ERROR"
210 PRINT "IN THE DATA SOMEWHERE."
220 STOP
230 :
500 DATA 165,1,41,254,133,1,169
505 DATA 255,141,3,221,169,13,32
510 DATA 137,192,169,27,32,137,192
515 DATA 169,51,32,137,192,169,23
520 DATA 32,137,192,32,201,192,134
525 DATA 158,173,213,192,133,159,169
530 DATA 25,133,183,169,40,133,155
535 DATA 32,176,192,160,7,177,158
540 DATA 153,25,0,136,16,248,160
545 DATA 7,162,7,22,25,102,2
550 DATA 202,16,249,165,2,44,212
555 DATA 192,16,2,73,255,32,137
560 DATA 192,32,137,192,32,137,192
565 DATA 136,16,226,165,158,24,105
570 DATA 8,133,158,144,2,230,159
575 DATA 198,155,208,199,169,13,32
580 DATA 137,192,32,201,192,198,183
585 DATA 208,180,165,1,9,1,133
590 DATA 1,169,27,32,137,192,169
595 DATA 64,76,137,192,72,72,173
600 DATA 13,221,104,141,1,221,173
605 DATA 0,221,41,251,141,0,221
610 DATA 234,9,4,141,0,221,173
615 DATA 13,221,41,16,208,7,32
620 DATA 225,255,240,205,208,242,104
625 DATA 96,169,27,32,137,192,169
630 DATA 42,32,137,192,169,3,32
635 DATA 137,192,169,192,32,137,192
640 DATA 169,3,76,137,192,162,20
645 DATA 169,32,32,137,192,202,208
650 DATA 250,96,0,160
```

GRAPHICS DUMP. ASSEMBLER

```
160 *=$C000 !START ADDRESS, 49152
170 !
180 CIAMASK     =  $DD0D        !THE TOP FOUR ADDRESSES
190 DATDIRB     =  $DD03        !ARE PART OF THE CENTRONICS
200 PORTA       =  $DD00        !CONTROL SYSTEM.  THIS IS
210 PORTB       =  $DD01        !CALLED 'OUTPUT' IN THE PROGRAM
211 ADDR        =  $9E          !ADDRESS FOR SCREEN DATA
212 LINES       =  $B7          !NUMBER OF SCREEN LINES OF 8 BYTES
213 SETS        =  $9B          !NUMBER OF 8*8 BLOCKS PER LINE
214 BUFFER      =  $19          !TEMPORARY 8 BYTE BUFFER
215 BYTE        =  $02          !WHERE OUTPUT CHARACTER IF FORMED
216 STOP        =  $FFE1        !CHECK STOP KEY (KERNAL)
220 !
500 !
510 !
520 DUMPIT      LDA $01         !THIS TAKES OUT BASIC ROM
530             AND #%11111110  !AS MANY PROGRAMS PUT A
540             STA $01         !HI-RES SCREEN BEHIND IT
545             LDA #$FF        !SET THE DATA DIRECTION REGISTER
546             STA DATDIRB     !FOR THE CIA CHIP
550 !
555             LDA #13         !CLEAR PRINTER BUFFER
556             JSR OUTPUT      !BY PRINTING A 'RETURN' CHARACTER
560             LDA #27         !SET LINE SPACING TO 23/217
570             JSR OUTPUT      !THIS ALLOWS THE LINES TO
580             LDA #'3         !JOIN UP AT THE TOP AND BOTTOM
590             JSR OUTPUT
600             LDA #23
610             JSR OUTPUT
615             JSR SPACES      !PRINT X SPACES TO CENTRE DUMP
620 !
630             STX ADDR        !X=0 FROM EARLIER ROUTINE
650             LDA ADDRESS     !GET ADDRESS OF SCREEN FROM
660             STA ADDR+1      !LATER ON IN ROUTINE
670 !
680             LDA #25         !THIS IS THE NUMBER OF SCREEN
690             STA LINES       !LINES OF 320*8 BLOCKS
700 !
710 LOOP2       LDA #40         !40 SETS OF 8*8 BLOCKS
720             STA SETS        !SET THE VALUE
725             JSR SETBITMODE  !SET BIT IMAGE MODE
730 !
740 LOOP6       LDY #$07        !8 BYTES TO BUFFER
750 LOOP3       LDA (ADDR),Y    !GET DATA FROM SCREEN
760             STA BUFFER,Y    !STORE IN BUFFER
770             DEY
780             BPL LOOP3       !MORE TO TRANSFER
790 !
795             LDY #$07        !8 BITS TO 'ROLL' OFF
800 LOOP7       LDX #$07        !FROM 8 BYTES
810 LOOP4       ASL BUFFER,X    !BIT ---> CARRY
820             ROR BYTE        !CARRY ---> BYTE (BIT 7)
830             DEX
840             BPL LOOP4       !MORE BITS
850 !
860             LDA BYTE        !GET BYTE FOR PRINTER
861 !
862             BIT INVERSE     !INVERT IT ?
863             BPL NOINV       !NO...
864 !
865             EOR #$FF        !INVERT ALL BITS
866 !
870 NOINV       JSR OUTPUT      !SEND TO PRINTER
872             JSR OUTPUT      !AND AGAIN...
873             JSR OUTPUT      !DITTO...
875             DEY             !MORE BITS ?
877             BPL LOOP7       !YES
880 !
890             LDA ADDR        !ADD 8 TO ADDRESS
900             CLC             !AS JUST PRINTED 8 BYTES
910             ADC #$08
920             STA ADDR
930             BCC SKIP        !NO OVERFLOW
940             INC ADDR+1
950 SKIP        DEC SETS        !FINISHED LINE ?
960             BNE LOOP6       !NO, SO BACK TO 'LOOP6'
970 !
980             LDA #$0D
990             JSR OUTPUT      !PRINT A 'RETURN' CHARACTER
993             JSR SPACES      !AND MORE SPACES
1000 !
1010            DEC LINES       !ANY MORE LINES ?
1020            BNE LOOP2       !YES...
1030 FINISH     LDA $01         !PUT BACK BASIC ROM
1031            ORA #%00000001
1032            STA $01
1033 !
1035            LDA #27         !SEND ESC + '@' TO RESET
1036            JSR OUTPUT      !PRINTER
1037            LDA #'@
1038            JMP OUTPUT      !EXIT VIA 'OUTPUT'
1040 !
2000 !
2005 OUTPUT     PHA             !STORE VALUE TO OUTPUT
2006            PHA             !AND AGAIN
2045            LDA CIAMASK     !CLEAR STUFF
2047            PLA             !GET BACK ONE BYTE
2100            STA PORTB       !PUT IT ON PORT FOR PRINTER TO READ
2110            LDA PORTA       !GET STROBE BYTE
2120            AND #%11111011  !TOGGLE STROBE
2130            STA PORTA       !SEND IT
2135            NOP             !SIMPLE PAUSE TO GIVE SLOW PRINTERS
2140            ORA #%00000100  !TIME, AND PUT IT BACK
2150            STA PORTA       !TO FINISH DATA TRANSFER
2175 READY      LDA CIAMASK     !PRINTER RECIEVED IT YET ?
2180            AND #%00010000  !BIT 4 YET ?
2190            BNE ATLAST      !YES, PRINTED CHARACTER OK
2191            JSR STOP        !HAVE YOU PRESSED STOP KEY ?
2192            BEQ FINISH      !YES, SO FINISH
2193            BNE READY       !NO, SO KEEP ON CHECKING
2195 ATLAST     PLA             !GET BACK SECOND VALUE
2200            RTS
2240 !
4080 !
```

(listing continued opposite)

GRAPHICS DUMP. ASSEMBLER

```
4090 SETBITMODE  LDA #27        !SET QUADRUPLE DENSIJY
4100             JSR OUTPUT     !BIT IMAGE GRAPHICS
4110             LDA #'*        !PRINTING.  THIS IS FOR
4120             JSR OUTPUT     !AN EPSON FX80, BUT SHOULD
4121             LDA #3         !WORK ON RX,MX, SHINWA, STAR
4122             JSR OUTPUT     !AND OTHER EPSON CLONES
4130             LDA #192       !3*320=3*256+192
4140             JSR OUTPUT     !BYTES OF DATA PER LINE
4150             LDA #3
4160             JMP OUTPUT     !EXIT VIA OUTPUT
4180 !
```

```
6000 SPACES      LDX #20        !NUMBER OF SPACES
6010             LDA #$20       !SPACE CHARACTER
6020 LOOPS       JSR OUTPUT
6030             DEX
6040             BNE LOOPS
6050             RTS
7000 !
7010 INVERSE     BYT $00        !0=NORMAL, $80=INVERSE
7020 ADDRESS     BYT $A0        !JUST THE HI-BYTE OF THE ADDRESS
7030 !
```

LABEL PRINTER

THIS IS a program from Frank Rooney, designed for the Commodore 64 and an Epson MX-80 printer to print neat labels for everything from discs to jam jars on standard continuous-roll blanks.

The layout, print size and intensity can all be selected by the user and several copies can be printed if required.

The program is self-explanatory, and could be modified for other printers by replacing the control codes in the various Print# statements in the program. The table shows the printer codes used in the program and there is an example of the print types available.

EPSON CONTROL CODES

```
CHR$(27)"@"  - initialise printer
CHR$(27)"O"  - cancel skip over  perforations
CHR$(27)"2"  - set line spacing
CHR$(27)"S1" - select subscript mode
CHR$(27)"T"  - cancel subscript mode
CHR$(27)"E"  - select emphasised print
CHR$(27)"F"  - cancel emphasised print
CHR$(27)"G"  - select over-print mode
CHR$(27)"H"  - cancel over-print mode
CHR$(15)     - select condensed print
CHR$(18)     - cancel condensed print
CHR$(14)     - select enlarged print
```

LABEL PRINTER

```
100 DIM T(3,7),P(7),E(34),L$(8),K(8),D(8)
110 NP$="[RED]  [RVS] 1 [RVOFF] NORMAL PRINT"
    :DP$="[RED]     [RVS] 2 [RVOFF] DOUBLE PRINT"
120 EP$="[RED]      [RVS] 3 [RVOFF] EMPHASISED PRINT"
130 DE$="[RED]      [RVS] 4 [RVOFF] DOUBLE EMPHASISED PRINT"
140 LN$="[GREEN][SHIFT-C 40]"
150 SP$="[SPACE 40]"
160 POKE 53281,15:POKE 53280,15:PRINT"[CLEAR]"TAB(11)"[RED,RVS]
     LABEL PRINTER [RVOFF]"
170 PRINT"[DOWN,BLUE] [FOR CBM 64 AND EPSON MX-80 PRINTER]"
180 PRINT TAB(11)"[DOWN,RED]BY FRANK ROONEY"
190 PRINT"[DOWN]  THIS PROGRAMME WILL PRINT STANDARD"
200 PRINT"TRACTOR-FEED LABEL SHEETS. THERE ARE 6"
210 PRINT"PRINT-SIZES, AND ANY ALPHA-NUMERIC"
220 PRINT"SYMBOLS, [RED]EXCEPT "CHR$(34)CHR$(34)"
    : OR , MAY BE USED."
230 PRINT"[DOWN]  THERE ARE 8 LINES PER LABEL, AND THE"
240 PRINT"PRINT-SIZE CAN BE SELECTED FOR EACH":PRINT"LINE."
250 PRINT"[DOWN,BLUE] PRESS [RVS]Y[RVOFF]
     IF THE PRINTER IS CONNECTED"
260 GET A$:IF A$="Y"THEN 280
270 GOTO 260
280 OPEN 4,4:PRINT#4,CHR$(27)"@"CHR$(27)"O"CHR$(27)"2":CLOSE 4
290 PRINT"[DOWN,RED]HOW MANY COLUMNS OF LABELS ? (1, 2 OR 3)"
300 GET LW$:LW=VAL(LW$):IF LW<1 OR LW>3 THEN 300
310 IF LW=1 THEN 330
320 FOR X=1 TO(((LW-1)^2)+1)*6:READ Z:NEXT X
330 FOR I=2 TO 7:READ P(I):NEXT I
340 FOR L=1 TO LW:FOR K=2 TO 7:READ T(L,K):NEXT K:NEXT L
350 PRINT"[RED]LOAD THE LABEL SHEET AND ALIGN THE"
360 PRINT"PRINTER HEAD TO PRINT THE TOP LINE ON"
    :PRINT"THE LABEL."
370 PRINT"[DOWN,BLUE]      [RVS] PRESS ANY KEY TO CONTINUE
    [RVOFF,HOME]"
380 GET K$:IF K$=""THEN 380
390 GOTO 1000
400 PRINT"[CLEAR,RED]KEY:"TAB(11)"[RVS] 1 [RVOFF] BLANK LINE"
410 PRINT TAB(11)"[RVS] 2 [RVOFF] CONDENSED SUBSCRIPT"
420 PRINT TAB(11)"[RVS] 3 [RVOFF] CONDENSED"
430 PRINT TAB(11)"[RVS] 4 [RVOFF] SUBSCRIPT"
440 PRINT TAB(11)"[RVS] 5 [RVOFF] NORMAL"
450 PRINT TAB(11)"[RVS] 6 [RVOFF] 66 CHRS PER LINE"
460 PRINT TAB(11)"[RVS] 7 [RVOFF] LARGE"
470 PRINT LN$:RETURN
480 PRINT"[CLEAR]";:B$="LABELS":IF LW=1 THEN 570
490 PRINT"[RED]PRESS [RVS] 1 [RVOFF] TO PRINT [RVS]ACROSS
    [RVOFF] THE SHEET"
500 PRINT"      [RVS] 2 [RVOFF] TO PRINT [RVS]DOWN[RVOFF]
     THE SHEET"
510 GET AD$:AD=VAL(AD$):IF AD<1 OR AD>2 THEN 510
520 IF AD=1 THEN B$="ROWS OF LABELS":GOTO 570
530 PRINT"[DOWN2]IN WHICH COLUMN DO YOU WISH TO PRINT ?[RED]"
540 PRINT"(PRESS [RVS]1[RVOFF] OR [RVS]2[RVOFF] ETC.)";
550 GET L$:L=VAL(L$):IF L<1 OR L>LW THEN 550
560 PRINT L
570 PRINT"[DOWN2]HOW MANY "B$" TO BE PRINTED [BLUE]"
    :INPUT"[DOWN]                    ";N
580 PRINT"[DOWN2]    [RVS] PRESS <S> TO START PRINTING [RVOFF]"
590 GET A$:IF A$="S"THEN 610
600 GOTO 590
610 OPEN 4,4:FOR M=1 TO N
620 FOR I=1 TO 8
630 IF AD=1 THEN FOR L=1 TO LW:PRINT#4,
    CHR$(27)"@"CHR$(27)"O"CHR$(27)"2";
640 IF AD=1 THEN PRINT#4,SPC(T(L,K(I)));:GOTO 660
650 PRINT#4,TAB(T(L,K(I)));
660 ON K(I)GOTO 670,680,690,710,720,750,780
670 PRINT#4,;:GOTO 810
680 PRINT#4,CHR$(27)"S1"CHR$(15);:GOTO 810
690 PRINT#4,CHR$(15);:IF D(I)=2 THEN PRINT#4,CHR$(27)"G";
700 GOTO 810
710 PRINT#4,CHR$(27)"S1";:GOTO 810
720 IF D(I)>2 THEN PRINT#4,CHR$(27)"E";
730 IF D(I)=2 OR D(I)=4 THEN PRINT#4,CHR$(27)"G";
740 GOTO 810
750 PRINT#4,CHR$(15)CHR$(14);
760 IF D(I)=2 THEN PRINT#4,CHR$(27)"G";
770 GOTO 810
780 PRINT#4,CHR$(14);
790 IF D(I)>2 THEN PRINT#4,CHR$(27)"E";
800 IF D(I)=2 OR D(I)=4 THEN PRINT#4,CHR$(27)"G";
810 PRINT#4,L$(I);
820 ON K(I)GOTO 890,830,840,850,860,870,880
830 PRINT#4,CHR$(27)"T"CHR$(18);:GOTO 890
840 PRINT#4,CHR$(18);:GOTO 890
850 PRINT#4,CHR$(27)"T";:GOTO 890
860 PRINT#4,CHR$(27)"F";:GOTO 890
870 PRINT#4,CHR$(18);:GOTO 890
880 PRINT#4,CHR$(18)CHR$(27)"F";:GOTO 890
890 PRINT#4,CHR$(27)"H";
900 IF AD=1 THEN NEXT L
910 PRINT#4,"":NEXT I:PRINT#4,"":NEXT M
920 CLOSE 4
930 PRINT"[CLEAR,DOWN4,BLUE]PRESS [RED,RVS] M [RVOFF] [BLUE]
    FOR [RED,RVS] MORE [RVOFF] [BLUE]OF THIS LABEL"
940 PRINT"[DOWN]      [RED,RVS] N [RVOFF] [BLUE]FOR A [RED,RVS]
     NEW [RVOFF] [BLUE]LABEL FORMAT"
950 PRINT"[DOWN]      [RED,RVS] E [RVOFF] [BLUE]TO [RED,RVS]
     EXIT [RVOFF] [BLUE]FROM THE PROGRAM"
960 GET A$:IF A$="E"THEN POKE 53280,14:POKE 53281,6
    :PRINT"[CLEAR]":NEW
970 IF A$="M"THEN 480
980 IF A$="N"THEN 1000
990 GOTO 960
1000 FOR II=1 TO 8:D(II)=0:L$(II)="":NEXT II:I=1
1010 PRINT"[CLEAR,RED]  DO YOU REQUIRE AUTOMATIC CENERING ?"
1020 PRINT TAB(15)"[DOWN](Y OR N)"
1030 GET C$:IF C$="Y"THEN C=1:GOTO 1060
1040 IF C$="N"THEN C=0:GOTO 1060
1050 GOTO 1030
1060 GOSUB 400
1070 PRINT"[DOWN,BLUE]LINE"I"KEY:"
1080 GET A$:K(I)=VAL(A$):IF K(I)<1 OR K(I)>7 THEN 1080
1090 IF K(I)=1 THEN 1260
1100 PRINT"[CLEAR]";:IF K(I)=3 OR K(I)>4 THEN PRINT"[RED]KEY:";
1110 IF K(I)=3 THEN VC=2:PRINT NP$:PRINT DP$:PRINT LN$
     :GOTO 1160
1120 IF K(I)=5 THEN VC=4:PRINT NP$:PRINT DP$:PRINT EP$
     :PRINT DE$:PRINT LN$:GOTO 1160
1130 IF K(I)=6 THEN VC=2:PRINT NP$:PRINT DP$:PRINT LN$
     :GOTO 1160
1140 IF K(I)=7 THEN VC=4:PRINT NP$:PRINT DP$:PRINT EP$
     :PRINT DE$:PRINT LN$:GOTO 1160
1150 GOTO 1170
1160 GET A$:D(I)=VAL(A$):IF D(I)<1 OR D(I)>VC THEN 1160
1170 PRINT"[DOWN,RED]LINE"I
1180 PRINT"[HOME,DOWN13,RIGHT2]";:FOR A=1 TO P(K(I))-1
     :PRINT"[GREEN]-";:NEXT A:PRINT"-[BLUE]"
1185 IF P(K(I))>37 THEN PRINT"[UP]";
1190 PRINT"[UP4]":INPUT L$(I)
1200 FOR B=1 TO P(K(I))
1210 IF PEEK(1465+B)<>32 THEN 1230
1220 NEXT B
1230 L$(I)=LEFT$(SP$,B-1)+L$(I)
1240 IF C=0 THEN 1260
1250 L$(I)=LEFT$(SP$,INT(P(K(I))-LEN(L$(I)))/2)+L$(I)
1260 I=I+1:IF I<9 THEN 1060
1270 PRINT"[CLEAR]THE COMPLETE LABEL READS:[DOWN2]"
1280 PRINT LN$:PRINT"[BLUE]";:FOR I=1 TO 8:PRINT L$(I):NEXT I
     :PRINT LN$
1290 PRINT"[RED,DOWN2]DOES THIS LOOK O.K. ? (Y OR N)"
1300 GET A$:IF A$="Y"THEN 480
1310 IF A$="N"THEN 1000
1320 GOTO 1300
1330 DATA 50,50,29,29,25,15
1340 DATA 0,0,0,0,0,0
1350 DATA 53,53,36,36,25,18
1360 DATA 3,3,0,0,3,0
1370 DATA 46,46,44,44,47,44
1380 DATA 33,33,21,21,18,12
1390 DATA 2,2,1,1,1,0
1400 DATA 30,30,29,29,29,28
1410 DATA 57,57,57,57,56,56
```

BY BILL HILL

DOS REPAIR

THIS UTILITY PROGRAM submitted by Jason Smith can be used to replace the corrupted DOS on a disc with the DOS from a normal disc. This is useful when the DOS image on the disc is corrupted but all the other files on the disc are intact.

The Basic program uses the RWTS DOS subroutine to read the 48 sectors from the first three disc tracks and write them out again track by track on the corrupted disc. The program can be used with either one or two disc drives and with the controller card in slots 4 to 7. Do not try to copy normal DOS on to a copy-protected disc to make it copyable — you will be wasting your time as it will not work.

A damaged DOS image on the first three disc tracks can usually be corrected by using the Master Create program on the DOS 3.3 master disc. However, the program printed here is a good way to learn something about the DOS image on disc, especially if it is a beast that you have not come to grips with yet.

DOS REPAIR

```
  2  REM

DOS 3.3 DISK UTILITY
       BY:-  JASON W. SMITH


  5  GOSUB 1000
  7 G$ =  CHR$ (7): REM  CTRL-G (BE
     LL)
 10  TEXT : HOME
 20  INVERSE : HTAB 7: PRINT "DOS-
     MOVER : BY, JASON SMITH": NORMAL
     : POKE 34,1
 22  HTAB 1: VTAB 3: PRINT "FOR DO
     S ";: INVERSE : PRINT "3.3":
      NORMAL
 25  PRINT : PRINT : PRINT "THIS P
     ROGRAM WILL COPY THE FIRST 3
     "
 30  PRINT "TRACKS OF DATA FROM A
     NORMAL FORMATED"
 35  PRINT "DISK TO ONE ON WHICH D
     OS (TRACKS 0-2)"
 40  PRINT "HAS BEEN CORRUPTED."
 45  PRINT : PRINT
 50  PRINT "THIS PROGRAM IS USEFUL
      IF YOU HAVE": PRINT "A DISK
      THAT WON'T BOOT, BUT IS REA
     DABLE."
 55  PRINT : PRINT : PRINT : PRINT

 60  INVERSE : HTAB 9: PRINT "HIT
     <RETURN> TO CONTINUE": HTAB
     13: PRINT "OR <ESC> TO ABORT
     ": NORMAL
 65  POKE  - 16368,0
 70  WAIT  - 16384,128
 75  IF  PEEK ( - 16384) = 155 THEN
      POKE  - 16368,0: TEXT : HOME
     : END
 80  POKE  - 16368,0
 84  REM

<<PRINT SLOT/DRIVE NOS>>


 85  HOME
 90  PRINT : PRINT
 95  HTAB 1: VTAB 3: PRINT "SLOT="
     ;: INVERSE : PRINT S: NORMAL

100  HTAB 1: VTAB 5: PRINT "ORIGI
     NAL DRIVE=";: INVERSE : PRINT
     D1: NORMAL
105  HTAB 1: VTAB 6: PRINT "DESTI
     NATION DRIVE=";: INVERSE : PRINT
     D2: NORMAL
110  POKE 34,7: PRINT : PRINT
115  INPUT "DO YOU WISH TO CHANGE
      THESE?(Y/N)";A$
120  IF A$ = "Y" THEN  GOSUB 500
121  HOME : IF D1 <  > D2 THEN  GOTO
     300
122  REM

<<FOR 1 DISK-DRIVE>>


123  FOR T = 0 TO 2
124  HTAB 1: VTAB 7: PRINT "TRACK
     : ";: INVERSE : PRINT T: NORMAL

125  HOME : HTAB 1: VTAB 9: PRINT
     "PLACE FORMATTED DISK IN DRI
     VE ";D1
130  HTAB 1: VTAB 10: PRINT "AND
     PRESS <RETURN>."
135  POKE  - 16368,0
140  WAIT  - 16384,128
142  HTAB 10: VTAB 8: INVERSE : PRINT
     "READING": NORMAL
145  POKE RWTS + 36,T
150  POKE RWTS + 34,D1
152  POKE RWTS + 44,1
155  CALL RWTS
160  HOME
165  HTAB 1: VTAB 9: PRINT "PLACE
      ";: INVERSE : PRINT "DAMAGE
     D";: NORMAL : PRINT " DISK I
     N DRIVE ";D2
170  HTAB 1: VTAB 10: PRINT "AND
     PRESS <RETURN>."
175  POKE  - 16368,0
180  WAIT  - 16384,128
182  HTAB 20: VTAB 8: INVERSE : PRINT
     "WRITING": NORMAL
185  POKE RWTS + 34,D2
190  POKE RWTS + 44,2
195  CALL RWTS
200  NEXT T
205  PRINT : PRINT : PRINT : PRINT
     "DONE."
210  POKE  - 16368,0: GOTO 375
299  REM

<<FOR 2 DISK-DRIVES>>


300  HTAB 1: VTAB 9: PRINT "PLACE
      FORMATTED DISK IN DRIVE ";D
     1
305  HTAB 1: VTAB 11: PRINT "PLAC
     E DAMAGED DISK IN DRIVE ";D2

310  PRINT : PRINT "PRESS <RETURN
     > TO BEGIN"
315  POKE  - 16368,0
320  WAIT  - 16384,128
323  HOME : POKE 34,8
325  FOR T = 0 TO 2
326  HOME : NORMAL
327  HTAB 1: VTAB 8: PRINT "TRACK
     : ";: INVERSE : PRINT T: NORMAL

328  HTAB 10: VTAB 9: INVERSE : PRINT
     "READING"
330  POKE RWTS + 36,T
335  POKE RWTS + 34,D1
340  POKE RWTS + 44,1
345  CALL RWTS
347  HOME : HTAB 20: VTAB 9: INVERSE
     : PRINT "WRITING"
350  POKE RWTS + 34,D2
355  POKE RWTS + 44,2
360  CALL RWTS
365  NEXT T
367  NORMAL
370  PRINT : PRINT "DONE.": POKE
      - 16368,0
375  INPUT "DO YOU WISH TO MOVE D
     OS AGAIN?(Y/N)";A$
380  IF A$ = "Y" THEN 80
385  TEXT : HOME : END
499  REM

<<RE-CONFIGURE>>


500  PRINT : PRINT
505  INPUT "SLOT=";S: IF S < 4 OR
     S > 7 THEN  PRINT G$: GOTO 5
     05
510  INPUT "ORIGINAL DRIVE=";D1: IF
     D1 < 1 OR D1 > 2 THEN  PRINT
     G$: GOTO 510
515  INPUT "DESTINATION DRIVE=";D
     2: IF D2 < 1 OR D2 > 2 THEN
      PRINT G$: GOTO 515
520  INVERSE : HTAB 6: VTAB 3: PRINT
     S
525  HTAB 16: VTAB 5: PRINT D1
530  HTAB 19: VTAB 6: PRINT D2
535  POKE RWTS + 25,S * 16
540  POKE RWTS + 33,S * 16
600  NORMAL : HOME : VTAB 9: GOTO
     115
999  REM

<<POKE-IN M/C RWTS RTN>>


1000  FOR I = 37120 TO 37167: READ
      J
1005  POKE I,J: NEXT I
1010 RWTS = 37120:D1 = 1:D2 = 2:S
      = 6: RETURN
1015  DATA 162,143,142,41,145,162
      ,15,142,37,145,169,145,160,3
      2,32,217,3,206,41,145,206,37
      ,145,16,241,96,0,1,239,216,2
      54,254,1,96,1,0,17,15,26,145
      ,0,127,0,0,1,3,254,96
1016  REM
1017  REM ** WILL NOT WORK ON **
1018  REM ** COPY-PROTECTED   **
1019  REM **   DISKS!         **
1020  REM
```

PORTFOLIO CHECKER

THIS PROGRAM from Peter Acton of London seems tailor-made for the dynamic city tycoon, as it checks *Times* Portfolio cards against share prices.

The Portfolio rules say that each reader may hold only one card but some of my acquaintances spend ages totalling many cards in an attempt to improve the odds. Mr Acton's solution is to store the number of cards to check and their checkable content as data in his program. On running each morning, the program prompts once each for just those Portfolio shares required to total all the cards, and presents the individual card totals for comparison with the required dividend.

While written for the Apple IIe, the program can be modified for other micros — I expect most tycoons run 16-bit PCs these days.

PORTFOLIO CHECKER

```
 10  REM
PORTFOLIO
 20  REM
    BY
 30  REM
PETE ACTON
 40  REM
 50  GOSUB 840: REM INITIALISE
 60  GOSUB 100: REM GET TODAY'S NU
      MBERS
 70  GOSUB 600: REM CALCULATE AND
      PRINT RESULTS
 80  END
 90  REM
GET TODAY'S FIGURES
100  GOSUB 500: REM OUTPUT EMPTY
     GRID
110  VTAB 1: HTAB 10
120  PRINT "ENTER AMOUNTS"
130 ZZ = 1
140  IF X$(ZZ) = "X" THEN  GOSUB
```

(listing continued opposite)

PORTFOLIO CHECKER

```
380
150 IF ZZ < 40 THEN ZZ = ZZ + 1:
    GOTO 140
160 GOSUB 500: REM DISPLAY TODAY
    'S NUMBERS
170 VTAB 22: HTAB 1: PRINT "PRES
    S RETURN TO PRINT TODAY'S RE
    SULTS"
180 VTAB 18: HTAB 8: PRINT "ALTE
    R NO:     "
190 VTAB 18: HTAB 18
200 PRINT "  ";: HTAB 18
210 B$ = ""
220 GET A$
230 IF A$ =  CHR$ (13) GOTO 350
240 IF A$ < "1" OR A$ > "9" GOTO
    220
250 B$ = A$
260 PRINT A$;
270 GET A$: IF A$ =  CHR$ (13) GOTO
    320
280 IF A$ =  CHR$ (8) GOTO 190
290 IF A$ < "0" OR A$ > "9" GOTO
    270
300 IF  VAL (B$ + A$) > 40 GOTO
    270
310 PRINT A$
320 ZZ =  VAL (B$ + A$)
330 GOSUB 380: REM GET VALUE
340 GOTO 160
350 RETURN

360 REM
GET A VALUE

370 REM TO SKIP OVER A VALUE, TY
    PE A SPACE
380 B$ = ""
390 H = 10 *  INT ((ZZ - 1) / 10)
    + 4
400 V = ZZ - H + 7
410 HTAB H: VTAB V
420 GET A$: IF A$ = " " THEN  GOTO
    480
430 IF A$ = "+" OR A$ = "-" THEN
    B$ = A$: PRINT A$;: GOTO 460

440 IF A$ =  CHR$ (13) THEN 470
450 IF A$ =  > "0" AND A$ =  < "
    9" THEN B$ = B$ + A$: PRINT
    A$;
460 GET A$: GOTO 440
470 V(ZZ) =  VAL (B$)
480 RETURN

490 REM
DISPLAY TODAY'S VALUES

500 HOME
510 FOR ZZ = 1 TO 40
520 H = 10 *  INT ((ZZ - 1) / 10)
    + 1
530 V = ZZ - H + 4
540 HTAB H: VTAB V
550 PRINT ZZ;: HTAB H + 3
560 IF V(ZZ) <  > 0 THEN  PRINT
    V(ZZ)
570 NEXT
580 RETURN

590 REM
CALCULATE AND PRINT RESU
    LTS

600 FOR ZY = 1 TO C
610 FOR ZZ = 1 TO 8
620 N(ZY,0) = N(ZY,0) + V(N(ZY,ZZ
    ))
630 NEXT
640 NEXT

650 REM PRINT CARDS AND RESULTS
660 GOSUB 1040: REM START PRINTE
    R
670 FOR ZY = 1 TO C
680 PRINT
690 FOR ZZ = 1 TO 7 STEP 2
700 Z$ =  STR$ (N(ZY,ZZ))
710 PRINT  SPC( 3 -  LEN (Z$));Z
    $;
720 NEXT
730 PRINT
740 FOR ZZ = 2 TO 8 STEP 2
750 Z$ =  STR$ (N(ZY,ZZ))
760 PRINT  SPC( 3 -  LEN (Z$));Z
    $;
770 NEXT : PRINT
780 Z$ =  STR$ (N(ZY,0))
790 PRINT " TOTAL"; SPC( 6 -  LEN
    (Z$));Z$
800 NEXT : PRINT
810 PRINT D$"PR£0"
820 RETURN

830 REM
INITIALISATION

840 C = 8: REM NUMBER OF CARDS HE
    LD IN THE DIM STATEMENTS
850 DIM N(C,8): REM N HOLDS THE
    NUMBERS
860 DIM X$(40): REM X$ IS NOT NU
    LL IF THAT NUMBER IS TO BE U
    SED
870 DIM V(40): REM V HOLDS THE V
    ALUES FOR THE DAY
880 D$ =  CHR$ (4): REM PREFIX FO
    R DISK COMMANDS
890 FOR ZY = 1 TO C
900 FOR ZZ = 1 TO 8
910 READ N(ZY,ZZ)
920 X$(N(ZY,ZZ)) = "X"
930 NEXT : NEXT
940 DATA 06,07,15,19,22,30,31,36
950 DATA 09,10,12,15,21,29,35,40
960 DATA 10,11,19,20,21,26,27,38
970 DATA 12,15,19,20,21,26,27,38
980 DATA 12,15,19,20,21,26,27,40
990 DATA 12,15,23,30,32,33,38,39
1000 DATA 18,19,24,27,32,35,36,4
     0
1010 DATA 19,22,24,27,32,35,36,4
     0
1020 RETURN

1030 REM
PREPARE PRINTER

1040 PRINT
1050 PRINT D$;"PR£2"
1060 PRINT  CHR$ (1);"1D"
1070 PRINT  CHR$ (1);"72N"
1080 RETURN
```

CROUT'S METHOD

IF YOU are an engineer, there is a good chance that at some stage in your career you will need to use complex numbers — that is, numbers with both real and imaginary components. If you are an electrical engineer, or perhaps involved in radar design, you may well also need to solve sets of simultaneous linear equations using complex variables.

Simultaneous linear equations are usually written in the general form Ax = b where A is an N by N matrix of known coefficients, x is a column vector of N unknowns, and b is a column vector of N known values. The problem is to solve for x.

One of the algorithms used for solving simultaneous linear equations is Crout's Method. This month I am including two programs using Crout's Method: one to solve the usual set of linear equations involving just real quantities, and the second program to solve for the complex unknowns in a set of simultaneous linear equations consisting of complex coefficients. You can regard the first program as a special case of the second program.

The programs use arrays named AU() to store the N by N matrix of coefficients. The first index in array AU represents the row number, and the second index represents the column number. The (N + 1)th column of AU() holds the right-hand side of the simultaneous equations — that is, the (N + 1)th column of AU() contains the column vector b. Array X() holds the solution to the equations..

When you run the programs they will provide comprehensive prompts to show you what to enter. In the second program array AU() is three dimensional and array X() is two dimensional. The third index in array AU() and the second index in array X() are used to access the imaginary components of the elements. The ability to define arrays of more than two dimensions is one of the strong points of Applesoft Basic, and is an important consideration for those intending to use numerical methods on a microcomputer. Some versions of Basic only support arrays of up to two dimensions.

When using this sort of numerical analysis program on a microcomputer — or on a mini or mainframe for that matter — remember to check the computed answer with the original equations. This is because computer arithmetic is finite, and rounding errors can get quite bad when the number of equations is large.

CROUT'S METHOD

LISTING 1.

```
10  HOME
20  DIM AU(19,20),X(19)
30  REM * FOR SYSTEMS LARGER THAN
      20 UNKNOWNS, REDIMENSION AR
    RAYS AU AND X
40  PRINT "PROGRAM TO SOLVE SIMUL
    TANEOUS LINEAR"
50  PRINT "ALGEBRAIC EQUATIONS US
    ING CROUT'S METHOD"
60  PRINT : PRINT : INPUT "HOW MA
    NY UNKNOWNS ARE THERE ? ";N
70  PRINT : PRINT "INPUT THE ELEM
      ENTS OF THE A AND B"
80  PRINT "MATRICES AS FOLLOWS :"
      : PRINT
90  FOR L = 1 TO N
100 FOR M = 1 TO N
110 PRINT "A(";L;",";M;")"
120 INPUT AU(L - 1,M - 1): PRINT

130 NEXT M
140 NEXT L
150 FOR L = 1 TO N
160 PRINT "B(";L;")"
170 INPUT AU(L - 1,N)
180 NEXT L
190 REM * NOW FORM AUX. MATRIX
200 FOR L = 1 TO N
210 AU(0,L) = AU(0,L) / AU(0,0)
220 NEXT L
230 M = 0
240 FOR LL = 1 TO (N - 1)
250 M = M + 1
260 FOR L = LL TO (N - 1)
270 SU = 0
280 FOR K = 0 TO (M - 1)
```

(continued on next page)

CROUT'S METHOD

(continued from previous page)

```
290 SU = SU - AU(L,K) * AU(K,M)
300  NEXT K
310 AU(L,M) = AU(L,M) + SU
320  NEXT L
330  FOR MM = (M + 1) TO N
340 SU = 0
350  FOR K = 0 TO (LL - 1)
360 SU = SU - AU(LL,K) * AU(K,MM)

370  NEXT K
380 AU(LL,MM) = (AU(LL,MM) + SU) /
     AU(LL,LL)
390  NEXT MM
400  NEXT LL
410  REM * NOW USE BACK SUBSTITUT
     ION TO FIND SOLN.
420  PRINT "THE UNKNOWNS ARE :": PRINT

430  PRINT "X(";N;") = ",AU(N - 1
     ,N)
435 X(N - 1) = AU(N - 1,N)
440  FOR K = (N - 2) TO 0 STEP  -
     1
450 SU = 0
460  FOR L = (K + 1) TO (N - 1)
470 SU = SU - AU(K,L) * X(L)
480  NEXT L
490 X(K) = AU(K,N) + SU
500  PRINT "X(";(K + 1);") = ",X(
     K)
510  NEXT K
520  END
```

LISTING 2.

```
10  HOME
20  DIM AU(19,20,1),X(19,1)
30  REM  * FOR SYSTEMS LARGER THA
     N  20 UNKNOWNS, REDIMENSION
     ARRAY AU & X
40  PRINT "PROGRAM TO SOLVE SIMUL
     TANEOUS LINEAR"
50  PRINT "              COMPLEX NUM
     BER"
60  PRINT "ALGEBRAIC EQUATIONS US
     ING CROUT'S METHOD"
70  PRINT : PRINT : INPUT "HOW MA
     NY UNKNOWNS ARE THERE ? ";N
80  PRINT : PRINT "INPUT THE ELEM
     ENTS OF THE A AND B"
90  PRINT "MATRICES AS FOLLOWS :"
     : PRINT
100  FOR L = 1 TO N
110  FOR M = 1 TO N
120  PRINT "A(";L;",";M;")"
130  INPUT "REAL PART  ";AU(L - 1
     ,M - 1,0): PRINT
140  INPUT "IMAG. PART ";AU(L - 1
     ,M - 1,1): PRINT
150  NEXT M
160  NEXT L
170  FOR L = 1 TO N
180  PRINT "B(";L;")"
190  INPUT "REAL PART  ";AU(L - 1
     ,N,0): PRINT
200  INPUT "IMAG. PART ";AU(L - 1
     ,N,1): PRINT
210  NEXT L
220  REM * NOW FORM AUX. MATRIX
230 V = AU(0,0,0)
240 W = AU(0,0,1)
250  FOR L = 1 TO N
260 P = AU(0,L,0)
270 Q = AU(0,L,1)
280  GOSUB 940
290 AU(0,L,0) = R
300 AU(0,L,1) = I
310  NEXT L
320 M = 0
330  FOR LL = 1 TO (N - 1)
340 M = M + 1
350  FOR L = LL TO (N - 1)
360 RR = 0:II = 0
370  FOR K = 0 TO (M - 1)
380 P = AU(L,K,0)
390 Q = AU(L,K,1)
400 V = AU(K,M,0)
410 W = AU(K,M,1)
420  GOSUB 900
430 RR = RR - R
440 II = II - I
450  NEXT K
460 AU(L,M,0) = AU(L,M,0) + RR
470 AU(L,M,1) = AU(L,M,1) + II
480  NEXT L
490  FOR MM = (M + 1) TO N
500 RR = 0:II = 0
510  FOR K = 0 TO (LL - 1)
520 P = AU(LL,K,0)
530 Q = AU(LL,K,1)
540 V = AU(K,MM,0)
550 W = AU(K,MM,1)
560  GOSUB 900
570 RR = RR - R
580 II = II - I
590  NEXT K
600 P = AU(LL,MM,0) + RR
610 Q = AU(LL,MM,1) + II
620 V = AU(LL,LL,0)
630 W = AU(LL,LL,1)
640  GOSUB 940
650 AU(LL,MM,0) = R
660 AU(LL,MM,1) = I
670  NEXT MM
680  NEXT LL
690  REM * NOW USE BACK SUBSTITUT
     ION TO FIND SOLN.
700  PRINT "THE UNKNOWNS ARE :": PRINT

710  PRINT "X(";N;") = ";"(";AU(N
     - 1,N,0);",";AU(N - 1,N,1);
     ")"
720 X(N - 1,0) = AU(N - 1,N,0)
730 X(N - 1,1) = AU(N - 1,N,1)
740  FOR K = (N - 2) TO 0 STEP  -
     1
750 RR = 0:II = 0
760  FOR L = (K + 1) TO (N - 1)
770 P = AU(K,L,0)
780 Q = AU(K,L,1)
790 V = X(L,0)
800 W = X(L,1)
810  GOSUB 900
820 RR = RR - R
830 II = II - I
840  NEXT L
850 X(K,0) = AU(K,N,0) + RR
860 X(K,1) = AU(K,N,1) + II
870  PRINT "X(";(K + 1);") = ";"(
     ";X(K,0);",";X(K,1);")"
880  NEXT K
890  END
900  REM   CALC. (P+IQ)*(V+IW)
910 R = P * V - Q * W
920 I = P * W + V * Q
930  RETURN
940  REM   CALC. (P+IQ)/(V+IW)
950 R = (P * V + Q * W) / (V ^ 2 +
     W ^ 2)
960 I = (Q * V - P * W) / (V ^ 2 +
     W ^ 2)
970  RETURN
980  END
```

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FORTH DATABASE PROGRAM

IN THIS simple database program J Leonard shows off an unfamiliar side of Forth, a language unfairly regarded by many people as unsuited for anything other than technical applications. The program shows the interactive nature of Forth makes it highly suitable for writing neat, simple data-retrieval applications.

The program is written in standard Fig-Forth. Screens 1 to 3 hold the Forth code itself, while screens 4 onwards are used for data storage. As it stands the program limits you to 48 records, but you can increase this by altering the constant Nofiles.

Five fields have been used for each entry headed Surname, Christian, Phone, Birth and Trade. The number and sizes of fields can be adjusted for other uses of the application. The complete application is loaded using

1 LOAD

New entries are made by entering the word Enter, which initiates prompts for the five fields.

Data is retrieved and manipulated by the following procedures. To locate an entry or entries of persons having the surname Leonard enter

FIND SURNAME LEONARD

The first entry in the index which contains this surname will be screened. If this is not the one required, enter Another or All. Provided there are others, the next or all will be screened. Once the correct entry has been located other fields can be screened using, for example,

GET PHONE

The full entry can be screened by using Entry.

Data can also be retrieved if other fields are specified in the keyboard entry, for example.

FIND TRADE PLUMBER

Entries can be erased by first locating them using the above techniques and then entering Remove. A field can be changed after locating the entry by

CHANGE PHONE 016613609

To terminate usage enter End to ensure all data screens that have been updated are recorded.

FORTH PERSONAL RECORDS

```
 0  ( PERSONAL RECORDS )
 1  : ['] ' ' CFA EXECUTE 2+ ;
 2  : TABLE <BUILDS , , DOES> ;
 3  : =$ SWAP 0 DO 2DUP C@ SWAP C@ = NOT IF 2DROP 0 LEAVE
 4    ELSE 1+ SWAP 1+ THEN LOOP IF DROP 1 ELSE 0 THEN ;
 5    15  0 TABLE SURNAME      10 15 TABLE CHRISTIAN
 6    12 25 TABLE PHONE         8 37 TABLE BIRTH
 7    17 45 TABLE TRADE        64 CONSTANT REC-LEN
 8    16 CONSTANT REC/BLK       4 CONSTANT FILE
 9     3 CONSTANT NOFILES      NOFILES REC/BLK * CONSTANT MAXRECS
10     0 VARIABLE PRESENT       0 VARIABLE KIND
11  : RECORD PRESENT @ REC/BLK /MOD FILE + BLOCK SWAP REC-LEN * + ;
12  : 2PAD PAD 80 + ;
13  : READ 13 TEXT ;
14  : TOP 0 PRESENT ! ;
15  : DOWN 1 PRESENT +! ;  -->


 0  ( PERSONAL RECORDS CONT )
 1  : FIELD 2@ RECORD + SWAP ;
 2  : .FIELD FIELD -TRAILING TYPE SPACE ;
 3  : .NAME CR CHRISTIAN .FIELD SURNAME .FIELD 2 SPACES ;
 4  : PUT QUERY 13 TEXT PAD 1+ SWAP FIELD CMOVE UPDATE ;
 5  : STORE DUP KIND ! 2+ @ READ PAD 1+ 2PAD ROT CMOVE ;
 6  : NEXT 1 MAXRECS 0 DO I PRESENT ! RECORD C@ 33 < IF NOT LEAVE
 7    THEN LOOP IF CR ." FILE FULL  " QUIT THEN ;
 8  : LOOK 0 KIND @ MAXRECS PRESENT @ DO DUP FIELD 2PAD =$ IF
 9    SWAP NOT SWAP LEAVE ELSE I 1+ PRESENT ! THEN LOOP DROP ;
10  : MISSING CR ." NOT IN FILE  " ;
11  : ?SURNAME CR ." ENTER SURNAME  " SURNAME PUT ;
12  : ?CHRISTIAN CR ." ENTER CHRISTIAN NAME  " CHRISTIAN PUT ;
13  : ?PHONE CR ." ENTER PHONE NUMBER  " PHONE PUT ;
14  : ?BIRTH CR ." ENTER DATE OF BIRTH  " BIRTH PUT ;
15  : ?TRADE CR ." ENTER TRADE/PROFESSION  " TRADE PUT ;  -->


 0  ( PERSONAL RECORDS CONT )
 1  : ENTER NEXT ?SURNAME ?CHRISTIAN ?PHONE ?BIRTH ?TRADE ;
 2  : REMOVE RECORD REC-LEN ERASE UPDATE ;
 3  : CHANGE ['] PUT ;
 4  : GET ['] .FIELD ;
 5  : FIND ['] STORE TOP LOOK IF .NAME ELSE MISSING THEN ;
 6  : ANOTHER DOWN LOOK IF .NAME ELSE CR ." NO OTHERS  " THEN ;
 7  : ALL TOP BEGIN LOOK WHILE .NAME DOWN REPEAT ;
 8  : ENTRY CR TRADE BIRTH PHONE CHRISTIAN SURNAME
 9    5 0 DO .FIELD LOOP ;
10  : TITLE PAGE 10 SPACES ." PERSONAL RECORDS" CR CR ;
11  : LOADING ." PLEASE BE PATIENT" CR CR FILE DUP NOFILES + SWAP
12    DO I BLOCK LOOP ;
13  : END SFLUSH ;
14  TITLE LOADING TITLE SP!
15
```

MBASIC INDENT

WHATEVER its other virtues, MBasic does not format listings as well as the BBC Micro. David Dawe's Indent program sets out to improve the situation. It will clean up the presentation of any MBasic program stored in ASCII, indenting While-Wend and For-Next constructs for you. It also stores the updated version of your program to disc for Listing or Running. PC

MBASIC INDENT

```
210 TB$=CHR$(9)
220 INPUT "State NAME of program to be indented ";F$
230 OPEN "I",£1,F$+".BAS"
240 LINE INPUT £1,A$
250 CLOSE
260 IF ASC(A$)>=254 THEN 710
270 PRINT:PRINT:PRINT
280 PRINT "The indented version will be as follows:"
290 PRINT:PRINT:PRINT
300 OPEN "I",£1,F$+".BAS"
310 OPEN "O",£2,F$+".NEW"
320       WHILE NOT EOF(1)
330       LINE INPUT £1,A$
340                 FOR P=1 TO 6
350                 C$=MID$(A$,P,1)
360                 IF C$<"0" OR C$>"9" THEN 380 ELSE 370
370                 NEXT P
380       IF C$<>TB$ THEN 420
390       A$=LEFT$(A$,P-1)+RIGHT$(A$,LEN(A$)-P)
400       C$=MID$(A$,P,1)
410       GOTO 380
420       IF MID$(A$,P+1,3)="FOR" THEN T=T+1
430       IF MID$(A$,P+1,5)="WHILE" THEN T=T+1
440       L$=LEFT$(A$,P-1)
450                 FOR K=1 TO T
460                 L$=L$+TB$
470                 NEXT K
480       L$=L$+RIGHT$(A$,LEN(A$)-P+1)
490       PRINT L$
500       PRINT £2,L$
510       IF MID$(A$,P+1,4)="NEXT" THEN T=T-1
520       IF MID$(A$,P+1,4)="WEND" THEN T=T-1
530       GOTO 320
540       WEND
550 CLOSE
560 PRINT:PRINT
570 PRINT "Indent completed"
580 PRINT:PRINT
590 INPUT "Are you happy with the indented version (Y/N) ";R$
600 IF R$="Y" THEN 630
610 IF R$="N" THEN 680
620 GOTO 590
630 KILL F$+".BAS"
640 NAME F$+".NEW" AS F$+".BAS"
650 PRINT:PRINT
660 PRINT F$;" Has been updated with indents"
670 END
680 KILL F$+".NEW"
690 PRINT "No indent update performed"
700 END
710 PRINT "Source program not saved in ASCII."
720 END
```

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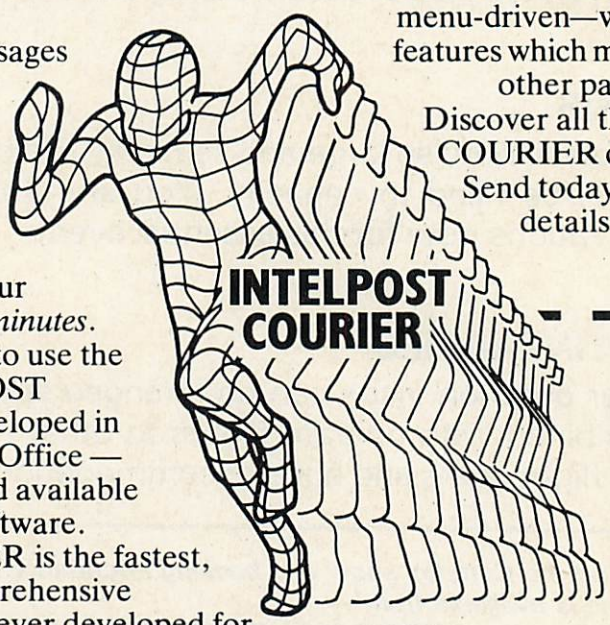

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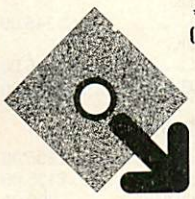

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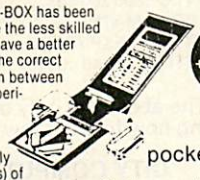

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